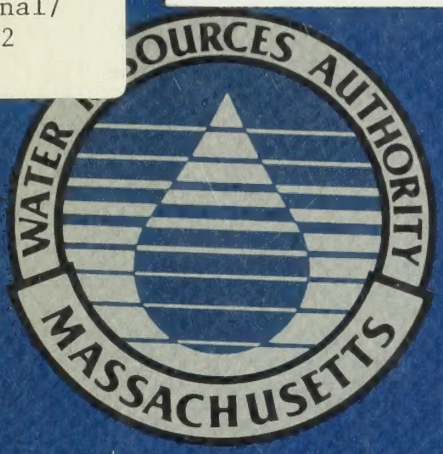
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Secondary Treatment Facilities Plan

VOLUME II
FACILITIES PLANNING BACKGROUND

Final Report

March 1, 1988



Secondary Treatment Facilities Plan

VOLUME II
FACILITIES PLANNING BACKGROUND

Final Report

March 1, 1988

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Notice to Reviewers

Attached for your review is the final report of Volume II, Facilities Planning Background of the Secondary Treatment Facilities Plan.

This document has been revised to reflect comments received during the review period for the draft report. A summary of the comments and responses will be included in Volume VIII, Public Participation and Responsiveness Summary, which will be distributed in April.

This document has received MWRA staff review but has not been accepted by the Board of Directors. The final report is being circulated at this time to seek additional public comment. The report will be submitted to the Board when the public review process is complete.

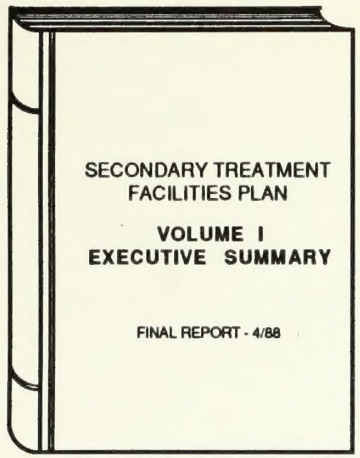
Daniel K. O'Brien
Acting Director
Engineering Division
March 1, 1988

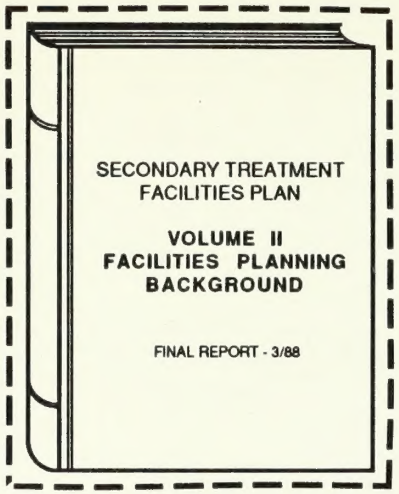
Public Participation Summary, which has been deleted from this Volume and is presented in Volume VIII, Public Participation and Responsiveness Summary.

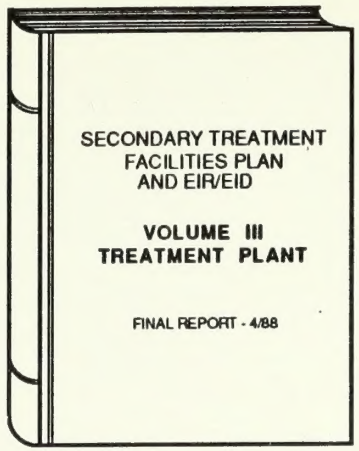
Since the draft report was issued, many valuable comments and suggestions were received and incorporated into this final report. All comments and responses are summarized in Volume VIII. The major changes since the draft report are revisions to Sections 5.0 and 6.0.

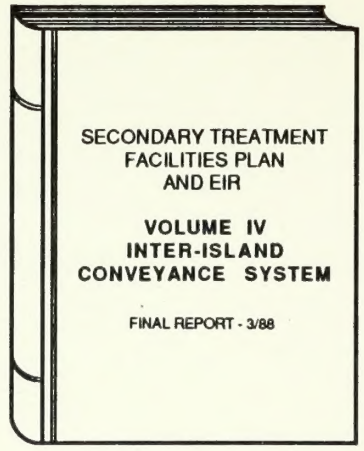
In Section 5.0 the Traffic Analysis clarifies plans for transporting workers, equipment, and materials in order to be consistent with mitigation commitments for busing, ferrying, and barging. The Air Quality section has been expanded to include a discussion of allowable ambient levels of air pollutants and other criteria as set by the Department of Environmental Quality Engineering. The third area of revisions to Section 5.0 is a more complete description of the Historical and Archaeological Resources on Deer Island.

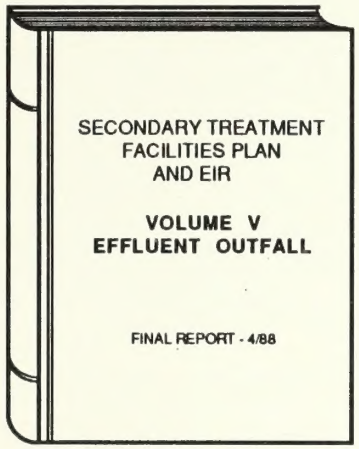
In Section 6.0 the major changes include clarification of the method used to estimate infiltration and inflow (I/I), and a discussion of the Authority's plans for I/I reduction. None of the estimates of flows and loads presented in the draft report has changed.

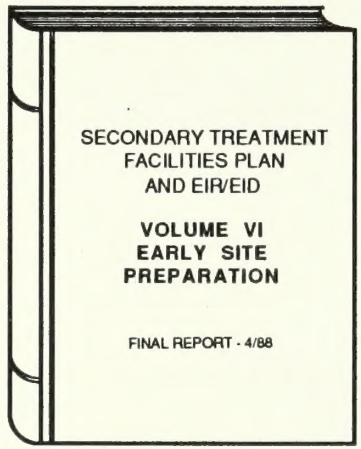


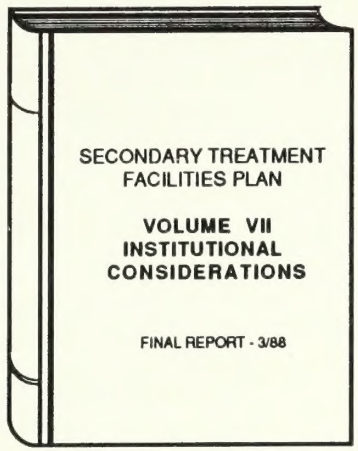


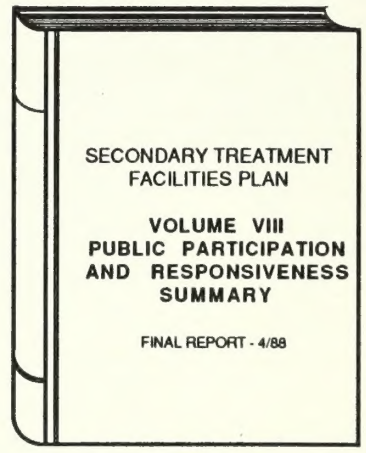












MASSACHUSETTS WATER RESOURCES AUTHORITY

DEER ISLAND SECONDARY TREATMENT FACILITIES PLAN VOLUME II

SECONDARY TREATMENT FACILITIES PLAN

Volume II
Facilities Planning Background
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SECTION 1.0 SUMMARY

1.1 PROJECT IDENTIFICATION

The following is Volume II, Facilities Planning Background, of the Secondary Treatment Facilities Plan. It is one of eight volumes that constitute the entire plan.

1.2 BRIEF DESCRIPTION OF PROJECT

The Secondary Treatment Facilities Plan evaluates the facilities needed to provide primary and secondary treatment of the wastewater conveyed through the Massachusetts Water Resources Authority's North and South Sewerage Collection Systems at a single treatment facility to be located on Deer Island. The Facilities Plan also evaluates the facilities needed to convey the South System flows from the existing Nut Island Plant to Deer Island, and the outfall facilities needed to convey the combined flows from Deer Island to a disposal point in marine waters.

This report describes the study, the work plan, and those factors that are common background for the detailed planning for the above-mentioned facilities.

This volume describes the need for the planning project and how it was accomplished. It summarizes previous studies for the clean-up of Boston Harbor and other, related Harbor clean-up projects. It also outlines the process of decision making in the siting of the new facilities, and the court-ordered dates for completion of the Facilities Plan.

Volume II also describes the planning period and the service area for the facilities, and criteria used to evalute all of the possible treatment processes in order to determine the most feasible, effective methods of treatment and their costs.

This volume examines the existing treatment facilities, environments, regulations, projected flows and loadings, and also outlines the environmental regulations that will affect the construction of the planned facilities.

2.0 INTRODUCTION

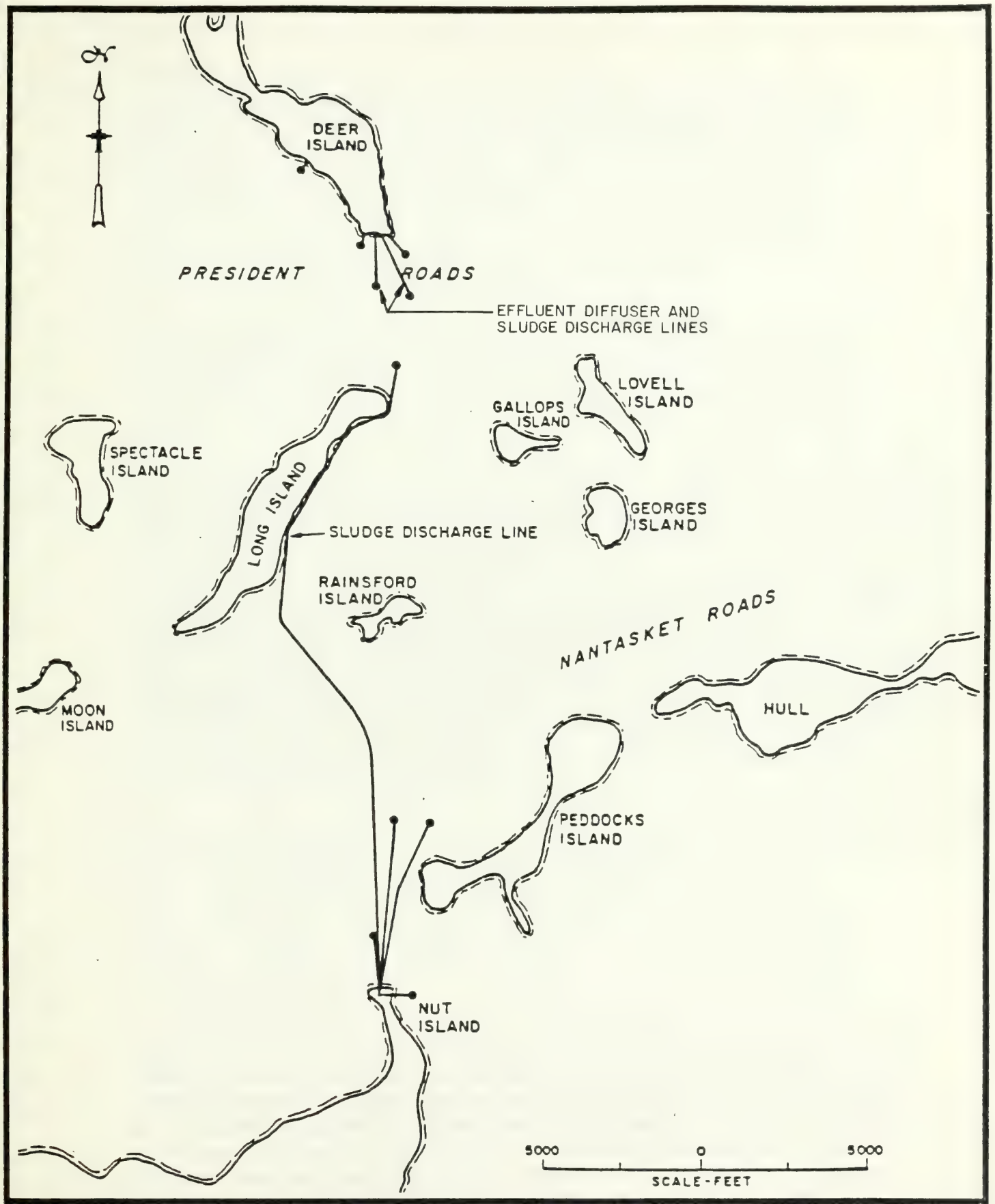
2.1 PROJECT NEED

Since the time of the Revolutionary War, Boston Harbor has been considered a national landmark. The largest seaport in New England, it supports a variety of marine activities including shipping, fishing, boating and recreation. It encompasses an area of 47 square miles bordered by residences, commercial buildings, restaurants, marinas, beaches, industries and shellfishing flats. But since the settlement of Boston's shore areas, and most particularly since the City of Boston took possession of Deer Island for "sanitary purposes" in 1847, the Harbor has been the receiving water for all of the domestic, commercial and industrial wastewater and stormwater from the Boston metropolitan area.

Today, nearly 5,000 miles of sewers, conduits and pipes collect sewage from 1.9 million people and 43 metropolitan cities and towns and transport it to the area's two sewage treatment plants at Nut Island and Deer Island for treatment prior to discharge to Boston Harbor. Both of the plants are designed to provide primary treatment. Each plant provides disinfection of the primary effluent prior to discharge to the Harbor to reduce the levels of pathogenic bacteria. The disinfected effluent from Deer Island is discharged through two diffuser equipped outfalls measuring 4600 and 5400 feet in total length, and discharging into President Roads approximately 1,900 and 2,500 feet from the Deer Island shoreline. Two additional relief outfalls, 135 and 500 feet long, extend approximately 50 and 500 feet from Deer Island.

The disinfected effluent from Nut Island is discharged north through two main outfalls into Nantasket Roads approximately 4,500-5,000 feet from Nut Island. During periods of high flows and/or extremely high tides a third outfall extending about 1,500 feet north into West Gut side of Hingham Bay may be used. In addition, an emergency outfall extends 500 feet into the Hingham Bay side of West Gut.

The sludges removed from both plants are anaerobically digested and discharged into President Roads on the outgoing tide. Sludge from Deer Island is discharged through the two diffuser equipped outfalls. The Nut Island sludge is discharged through a 4.2 mile sludge-only line. Figure 2.1-1 illustrates the location of each of the treatment facilities and discharge locations. The combined discharge of primary effluent and sludge to the relatively shallow waters of Boston Harbor imposes a significant burden on the marine and estuarine ecology in the waters surrounding the discharge. The discharge of floatable materials results in a significant deterioration in the aesthetic qualities of this vital resource. Because these discharges are but a few of the total discharges to Boston Harbor, and because scientific research to delineate the impacts of each discharge on the Harbor has been limited to date, the precise impacts of the primary effluent and sludge are difficult to quantify. However, these discharges are unquestionably very sizable and the materials being discharged are ecologically significant. Thus, every reasonable effort should be made to reduce these discharges.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 2.1-1 DEER ISLAND AND NUT ISLAND EFFLUENT AND SLUDGE DISCHARGE LOCATIONS

The Deer Island treatment facilities were constructed in 1968, and the Nut Island treatment facilities in 1952. Both facilities have exceeded their useful lives and the levels of treatment provided are often less than optimal because of the unavailability of replacement equipment. Nut Island has recently undergone a rehabilitation of most of its major components. A similar rehabilitation is now underway for Deer Island. Rehabilitation of the existing treatment facilities will optimize the levels of removal that these facilities can consistently provide. However, even the rehabilitated facilities cannot provide the levels of treatment desired. The design criteria and installed equipment of the existing primary facilities do not represent state-of-the art technology; therefore, they require replacement.

The 1972 Federal Clean Water Act requires that all municipal sewage treatment systems incorporate secondary treatment. Secondary treatment is more complex than the primary treatment that the flows at Nut Island and Deer Island currently receive, removing significantly higher levels of both organic materials and solids from wastewater (80 to 90 percent).

Like the Federal Water Pollution Control Act, the Massachusetts Clean Water Act requires promulgation of water quality standards for waters within the Commonwealth. The Massachusetts Division of Water Pollution Control has established these standards to satisfy the requirements of both acts. Thus, both Federal and State statutes require increased levels of treatment.

In 1982, the City of Quincy filed a suit against the Metropolitan District Commission (MWRA's predecessor agency) charging violations of laws prohibiting discharges into coastal waters and tidal waters, and violations of the common law of nuisance. As the suit progressed, the Massachusetts Water Resources Authority was created by the Massachusetts legislature. Almost simultaneously with MWRA's creation, the U.S. Environmental Protection Agency filed suit against MWRA alleging violations of the Clean Water Act. The Federal District Court found MWRA to be in violation and ordered the Authority to plan and construct new treatment facilities in accordance with an aggressive schedule (see Section 3.4.)

The need for upgraded and expanded treatment facilities to serve the Boston metropolitan area is clear: current discharges place a significant burden on one of the area's vital natural resources; the existing treatment facilities have long exceeded their useful lives; the existing treatment facilities do not reflect state-of-the-art technology and design; Federal and State statutes require enhanced levels of treatment; and the Federal Court has intervened and ordered an upgrading of the treatment facilities.

2.2 PLANNING APPROACH

This facilities planning study provides the foundation for the Massachusetts Water Resources Authority's program for the construction and operation of new primary and secondary wastewater treatment facilities at Deer Island. This planning has been approached with the understanding that the facilities planning effort must secure and sustain the acceptance and support of the diverse community, government, and business interests that it affects. Therefore, the planning process was based not on technical strength alone, but also on the continual reconciliation of political, legal, environmental, economic, and community interests.

A critical component of the facilities planning for secondary treatment facilities has been completed: the siting of the new treatment facilities. The decision-making process and the mitigation commitments made during that siting process are considered to be firm guidance for the planning to be undertaken in this project. (See Section 3.2 for a description of the siting decision.)

The successful treatment of wastewaters from the Boston metropolitan area requires not only that enhanced treatment facilities be provided, but also that reliable, environmentally sound facilities be provided to manage the disposal of the residuals that are the direct by-products of wastewater treatment. The residuals management facilities plan is being conducted as a separate but concurrent study. The facilities needed and the sites being considered for residuals management are quite different from those needed for secondary treatment. However, the schedule for completion of the residuals management facilities plan is similar to the schedule for this plan. In addition, the approach and work plans for both of these planning studies recognize the synergistic relationship of these two plans. Thus, this planning study must be read with full cognizance of the residuals management facilities planning. (See Section 3.3 for a discussion of the residuals management programs.) .

The facilities needed to provide secondary treatment include new primary and secondary treatment facilities located on Deer Island; a new conduit to convey the wastewaters from the existing Nut Island plant to Deer Island (inter-island conveyance facilities); and a new outfall to discharge the treated effluent into the ocean. In addition, a fourth component has been identified for the project: early site preparation. Early site preparation is defined as any construction activity that can start at an early date, i.e., before the completion of the on-island piers facilities needed to move the construction materials, equipment and personnel to the Deer Island site. The facilities planning for secondary treatment has thus been broken into four, stand-alone studies:

Treatment Plant, Volume III
Inter-Island Conveyance System, Volume IV
Effluent Outfall, Volume V
Early Site Preparation, Volume VI

To expedite the planning and review process, the facilities planning for secondary treatment has received a designation as a "major and complicated" project under the Massachusetts Environmental Policy Act regulations. The "major and complicated" project designation permits the environmental reviews to be concurrent with, and an integral part of, the facilities planning process, which includes the final environmental impact review (FEIR). Thus, the documents being prepared to summarize the facilities planning are the same documents that will be used for environmental reviews. The FEIR needs to be finalized before the Secretary of Environmental Affairs can issue an Executive Office of Environmental Affairs (EOEA) certificate. Once the certificate is issued, then the appropriate permits and licenses can be issued.

The scope and sequencing of these facilities planning and environmental review activities are described in the following section.

2.3 SCOPE OF WORK

The purpose of the Secondary Treatment Facilities Plan is to evaluate the facilities needed to provide primary and secondary treatment, at a single facility to be located on Deer Island, of the wastewater conveyed through MWRA's North and South Systems. It will evaluate the facilities needed to convey the South System flows from the existing Nut Island plant to Deer Island, as well as the outfall facilities needed to convey the effluent flows from Deer Island to a disposal point in marine waters. It will also identify and evaluate the construction activities which can occur as part of the Early Site Preparation effort prior to completion of the on-island piers and in preparation for the construction of the primary facilities.

The scope of work for the facilities plan is summarized below.

Project Management provides the overall project management required to ensure that the facilities plan is completed on time, within budget and with high standards of quality.

Data Collection inventories current and planned upgraded equipment and processes, assembles data regarding process equipment, mechanical, structural and hydraulic conditions, operating and maintenance characteristics, and expected useful life. Data Collection also will project flows and loadings, define the planning area, and provide a basis for evaluating further growth. This task will develop performance/removal criteria that will be used to balance the level of treatment required and the outfall location.

Facilities Engineering will characterize the wastewater to be treated, develop initial alternative planning and architectural concepts for Deer Island and ancillary facilities at Nut Island; complete site planning requirements; evaluate the adequacy of existing preliminary treatment facilities and evaluate unit processes for screening and grit removal; evaluate unit processes for primary treatment and residuals collection; evaluate unit processes for secondary treatment and residual collection; evaluate unit processes for disinfection; identify and evaluate the ability to control air emissions; establish alternative noise control methods and prepare a noise control plan for treatment plant operations and construction activities; determine the need for a pilot plant; evaluate the route and construction technology for locating and constructing the inter-island conveyance system and new effluent outfall; select an area for the outfall discharge which will meet water quality standards; characterize the soil and rock conditions under the proposed facility and related wastewater conveyance systems; identify and evaluate treatment processes; evaluate the reliability and flexibility of each of the treatment alternatives; estimate capital costs for the selected facilities and equipment; identify and estimate utility needs; identify operator needs and develop a preliminary operations plan; outline the requirements to operate the existing plants during construction; and provide pre-construction planning.

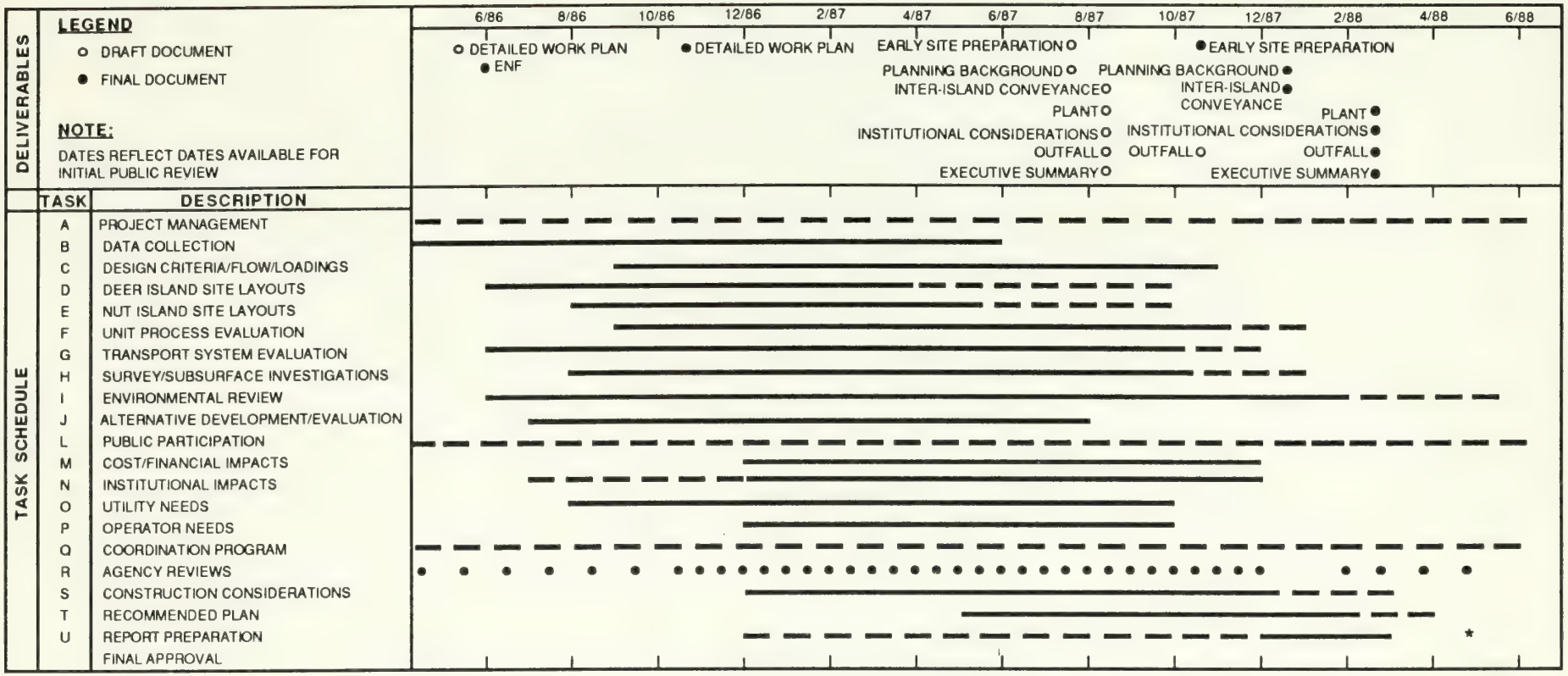
Institutional tasks include development of an annual cash flow projection required for the construction of the facilities; identification of the financial impacts of the recommended plan on MWRA's customers; identification of proposed changes or additional laws, regulations, legislative restrictions and agreements that may affect the implementation of the facilities plan; description of potential permit and regulatory agency approval requirements and preparation of a preliminary permitting plan; and implementation of a full-scale public participation program.

Recommended Plan is the preparation of the Secondary Treatment Facilities Plan and development of an implementation schedule/plan for each design and construction phase, as well as the coordination of, and response to, reviews by regulatory agencies.

A more detailed outline of each work task will be found in Appendix A. Figure 2.3-1 illustrates the general flow of the planning activities.

SCHEDULE OF MAJOR DELIVERABLES

VOLUME	NAME	DRAFT REPORT	FINAL REPORT
I	EXECUTIVE SUMMARY	11/87	4/88
II	FACILITIES PLANNING BACKGROUND	9/87	3/88
III	TREATMENT PLANT	11/87	4/88
IV	INTER-ISLAND CONVEYANCE SYSTEM	10/87	3/88
V	EFFLUENT OUTFALL	11/87	4/88
VI	EARLY SITE PREPARATION	9/87	4/88
VII	INSTITUTIONAL CONSIDERATIONS	11/87	3/88
VIII	PUBLIC PARTICIPATION AND RESPONSIVENESS SUMMARY		4/88



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 2.3-1
SECONDARY TREATMENT FACILITIES
PROJECT PLANNING SCHEDULE

3.0 PROJECT BACKGROUND

3.1 PREVIOUS STUDIES

Since 1900, there has been concern over water pollution problems in Boston Harbor. The State legislature initiated six investigations into the condition of the Harbor between 1900 and 1939. The last of these investigations resulted in the construction of the present Deer Island Treatment Plant which was completed in 1968.

But even as the Deer Island Plant was completed, the Federal Water Pollution Control Administration released a report on the impact of pollution on the Harbor's waters citing recreational, economic and biological impairment. The report generated increased interest in addressing pollution problems and at the first Enforcement Conference on Boston Harbor, state and federal officials agreed on the formation of a technical study group to explore measures for pollution abatement. The recommendations and agreements which grew out of these conferences, in conjunction with the mandates of the Federal Water Pollution Control Act and the Massachusetts Clean Water Act, have formed the framework for attacking pollution in Boston Harbor.

The process of identifying long-term wastewater treatment needs and solutions for the greater Boston Metropolitan area began in 1973 when the Metropolitan District Commission (MDC) began work on wastewater engineering and management planning for Boston Harbor. (Table 3.1-1 provides a list of planning reports for wastewater treatment in Boston Harbor.) The Eastern Massachusetts Metropolitan Area Wastewater Management and Engineering Study (EMMA) was conducted to ascertain what repair, replacement, extension, and expansion of facilities were required to provide adequate sewage treatment for the next fifty years.

In the fall of 1976, following publication of the EMMA Study, EPA's regional office requested that an Environmental Impact Statement (EIS) be prepared before any facilities planning. When the draft EIS was completed in 1978, it resolved the controversy regarding satellite facilities and proposed the consolidation of all planned treatment facilities on Deer Island.

A few months prior to the publication of the EIS, the MDC had responded to the 1977 amendments to the Clean Water Act which provided for a waiver of secondary treatment. If a waiver were granted, much of the construction contemplated in the EMMA Study would be deferred, at least until expiration of the modified permit, and perhaps indefinitely if the permit were renewed. Nevertheless, because regulations pertaining to the waiver process required that facilities plans to provide secondary treatment be prepared concurrently with the waiver process, the MDC, following release of the draft EIS, began preparation of a facilities plan.

Starting in 1983, the EPA and the Commonwealth jointly prepared the Supplemental Environmental Impact Statement/Environmental Impact Report (SEIS/DEIR) on the Site Options Study. The purpose of this document, which augmented the EIS evaluations done on the EMMA Study, was to review the environmental impacts of the Site Options Study alternatives, as well as other alternatives within the context of both the National and Massachusetts Environmental Policy Acts. The SEIS/DEIR started with twenty alternatives and selected seven treatment plant siting

alternatives for final review. The MWRA later reinstated one alternative for final review. Four alternatives involved secondary treatment and four involved primary treatment. The alternatives considered included locating all treatment facilities at Deer Island, all treatment facilities at Long Island, or combinations of plant locations that used Deer, Long, and Nut Islands together in various configurations.

Also in 1983, almost five years after MDC filed a preliminary application for waiver of secondary treatment, the application was tentatively denied by EPA. Because of intervening regulatory developments, MDC was entitled to file an amended application. Shortly thereafter, MDC notified EPA of its intent to do so, and a scope of study was agreed upon, including water sampling to be performed in the summer of 1984. Final submissions were made by MDC in October, 1984.

Although the cost implications of secondary treatment and the ultimate rate-payer impacts promoted pursuit of the waiver application over several years, the waiver application exacerbated two major problems in planning the cleanup of Boston Harbor. First, as long as the "level" of treatment (secondary vs primary) was uncertain, the nature and size of new treatment facilities were impossible to fix for planning purposes. Second, planning for sludge management was frustrated because of the disparity in both the tonnage and character of sludge from secondary treatment as opposed to primary treatment. On March 29, 1985, EPA rejected MDC's amended Section 301 (h) waiver application.

The Massachusetts Water Resources Authority assumed control of the MDC sewerage system on July 1, 1985. The MWRA made the decision to proceed as fast as possible with the secondary treatment program for Boston Harbor, notifying EPA that they would choose a preferred alternative for focused analysis by early July, 1985.

Table 3.1-1 lists planning projects undertaken for Boston Harbor wastewater treatment since the 1976 EMMA study.

3.2 SITING DECISION

The MWRA determined that the seriousness of the siting decision to be made and the newness of MWRA as a participant in the decision process merited a thorough review of the material presented in the SDEIS/DEIR and comments made pursuant to that document, as well as a consideration of all additional information being developed in response to the issues raised by those comments.

The MWRA began its site selection process by reviewing the six criteria established in the SDEIS/DEIR (i.e., cost, effects on natural and cultural resources, effects on neighbors, harbor enhancement, implementability, and reliability). The MWRA voted to adopt these six criteria, but determined that two additional criteria should be adopted as well: equitable distribution of regional responsibility; and mitigation measures. The first of the new criteria, equitable

TABLE 3.1-1

SUMMARY OF PLANNING REPORTS FOR WASTEWATER TREATMENT IN BOSTON HARBOR

1976, March	Eastern Massachusetts Metropolitan Area Wastewater Engineering and Management Plan of Boston Harbor, Metcalf & Eddy, Inc.
1976	Non-structural Controls for Combined Sewer Overflows, Environmental Research and Technology, Inc.
1976, May	Joint Task Force Report on Major Manned MDC Facilities Located in the Greater Boston Area, EPA Region I
1976, July	Wastewater Management Planning: Boston Metropolitan Area Phase I Study, Urban Systems Research and Engineering, Inc.
1976, July	Phase I Engineering Report Boston Case Study, Kennedy Engineers, Inc.
1976, August	Phase I Final Report on Greater Boston Water Quality Issues in Planning for Pollution Control, Verlex Corp.
1976, November	Boston Metropolitan Area Waste Treatment Feasibility Study, Stone & Webster Engineering Corp.
1979, January	Wastewater Treatment Facilities Planning in the Boston Metropolitan Area - A Case Study, Kennedy Engineers, Inc.
1979, September	Application for Modification of Secondary Treatment Requirements for Discharge into Marine Waters of Boston Harbor and Massachusetts Bay for its Deer Island and Nut Island Wastewater Treatment Plants, MDC
1980, December	MDC Headworks Grit and Screenings Removal Systems - Preliminary Report, Whitman and Howard, Inc.
1982, June	The Commonwealth of Massachusetts Nut Island Wastewater Treatment Plant Facilities Planning Project, Phase I, Site Options Study, Volumes I and II, Metcalf & Eddy, Inc.
1982	Nut Island Wastewater Treatment Plant Immediate Upgrading, Metcalf & Eddy, Inc
1984	Deer Island Facilities Plan, Havens & Emerson/Parsons Brinkerhoff

TABLE 3.1-1

SUMMARY OF PLANNING REPORTS FOR WASTEWATER TREATMENT IN BOSTON HARBOR
(Continued)

1984	Supplemental Draft Environmental Impact Statement and Draft Environmental Impact Report, EPA
1984	Application for a Waiver of Secondary Treatment for the Nut Island and Deer Island Treatment Plants, Metcalf & Eddy, Inc.
1985, November	Final Environmental Impact Report on Siting of Wastewater Treatment Facilities for Boston Harbor, Camp Dresser & McKee, Inc.
1985, December	Final Environmental Impact Statement on Siting of Wastewater Treatment Facilities for Boston Harbor, EPA

distribution of regional responsibility, was viewed as subsuming the "fairness" issue which had been the subject of substantial commentary on the SDEIS/DEIR. The second new criterion, mitigation measures, was adopted to ensure consideration of both environmental and non-environmental mitigation and to permit MWRA to fully respond to mitigation concerns during its siting deliberations.

The MWRA next reviewed the site options to be considered. It voted to examine the seven site alternatives proposed at the conclusion of the SDEIS/DEIR (all secondary Deer Island, split secondary Deer Island and Nut Island, all secondary Long Island, split secondary Deer Island and Long Island, all primary Deer Island, split primary Deer Island and Nut Island, split primary Deer Island and Long Island) and, in response to the Secretary's Certificate of Adequacy on the SDEIS/DEIR, also voted to reinstate for evaluation one site option that had been dropped from consideration at the close of the SDEIS/DEIR (all primary Long Island).

The MWRA then proceeded to an evaluation of each site alternative in the context of the criteria selected. A number of consultants were engaged to assist in the collection, evaluation, and presentation of pertinent materials to the Board members at their publicly held meetings. Oral and visual presentations on each of the eight criteria were given, followed by questions and discussions which refined the issues to be addressed and identified additional information to be obtained. Second presentations and discussions were held on seven of the criteria, and a third round of review and debate occurred on the criterion of cost. As a consequence of these deliberations, further presentations and discussions were held on several sub-topics that were of particular interest or thought to require additional attention.

In addition to its own consultants' presentations, the MWRA heard and discussed presentations by the Regional Administrator of EPA, by representatives of the Executive Office of Environmental Affairs and the Department of Environmental Quality Engineering, and by the technical and legal representatives of the Town of Winthrop and the City of Quincy. In all, the MWRA listened to and discussed at some length, 23 separate presentations on 13 different topics applicable to the preferred alternative siting decision.

A summary of all the siting presentations given and the Board's discussions was provided to the Board members for further review and analysis prior to the vote on the tentative preferred alternative site selection. Copies of letters from officials and the public concerning the siting decision were either provided to Board members during the ongoing deliberations or were included in the siting summary notebook. The Board members also visited the sites being considered.

The following subsections contain summaries of MWRA's deliberations concerning each criterion as it applied to the site selection to be made. Throughout the process of selecting the tentative preferred alternative site, MWRA evaluated and compared the information received in light of the criteria adopted. It observed interrelationships among the criteria and discussed the value to be accorded to the criteria in the context of various site alternatives. The last subsection summarizes the way in which the criteria weighed, one against the other, with respect to the sites considered.

3.2.1 EFFECT ON NEIGHBORS

The purpose of this criterion was to address treatment facility impacts on the neighbors of the treatment plant. Factors evaluated by MWRA were traffic, noise, odor, visual effects, property values, and health and safety issues. An exploration of the numbers of persons potentially impacted by the proposed primary, secondary and split treatment plant site options was conducted. Distinctions were made between those who might be voluntarily exposed to the negative impacts and those who resided nearby and had no choice with respect to being impacted, with greater value being accorded to the latter. Consideration was also given to the potential impact of the treatment plant on those working, living or staying at either the hospital on Long Island or the prison on Deer Island. Weight was attached to the fact that persons in the institutions would be closer to the source of impacts for longer continuous periods and would be exposed to a higher degree of impact at any given time. Concern about the effects on these populations served in part to motivate MWRA to analyze in more detail the "footprints" that could be accommodated on Long Island and on Deer Island and the need for and feasibility of mitigative design concepts, buffers, and/or the relocation of the respective institutions. Also considered was the exposure to impacts over a longer period of time as would be the case for most of the residential neighbors.

Traffic

Traffic access roads were reviewed for capacity and for anticipated peak and average use with and without the utilization of barging and busing. The MWRA learned that the greatest numbers of persons would be affected along the Winthrop access routes, but that a substantial number of persons would be affected along the East Squantum access routes as well. The fewest persons would be affected if the Quincy Shore Drive route to Long Island were available, but there were questions of implementability and structural feasibility that would have to be resolved in order to use that route. The degree of negative impact on the various roads was considered to be roughly the same for the various site alternatives.

A great deal of consideration was given to barging, with the recognition that it was required in order to sufficiently mitigate the traffic impacts that would be caused during construction. Implementability issues with regard to barging -- such as Coast Guard regulations and the construction of piers -- were explored, as were the costs of barging. A determination was made that the same requirements for barging applied to whichever site alternative was selected, and therefore the concerns surrounding barging as a mitigation measure for the alleviation of traffic impacts on neighbors were found to be not site-determinative.

Also reviewed were the potential mitigation measures of ferrying workers to decrease traffic, and rehabilitating or replacing access bridges to accommodate heavy trucking. Implementing each of these measures appeared to pose a relatively similar degree of difficulty between sites and was not found to be an absolute deterrent. The cost of bridge repair or construction did differ between sites and was explored in greater detail by MWRA in its concern for the issue of traffic impacts and the need to alleviate them. It was determined that it would be most costly to repair, replace or construct new bridges for access to Long Island. Assuming a heavy reliance upon barging and taking into account the above factors, MWR concluded that the traffic

impacts were significant but manageable with respect to all sites, and that this was not a site-determinative factor.

Noise

The information on noise contained in the SDEIS/DEIR was reviewed, and the concerns of the Town of Winthrop with respect to the adequacy of that information and the possible site-determinative nature of construction noise impacts were explored. Berms and temporary noise barriers were also discussed. The MWRA received a detailed letter from, and heard a presentation by, Winthrop's technical consultant. It further pursued additional noise information through the technical advisory group meetings and shared the ongoing work done by EPA's technical consultant. An update of this work was presented to MWRA by EPA shortly before MWRA's siting decision. The information on noise gathered and presented by EPA and adopted by MWRA for its tentative preferred alternative site selection indicated that although noise levels at Deer Island would result in greater impact to neighbors, particularly the close neighbors at the House of Correction, the level of construction noise at either site was at acceptable levels or could be sufficiently mitigated so that it was not a site-determinative issue.

Odor

The impact of odors, taking into consideration source, distance, population density, and potential for occurrence, was also evaluated. In addition to evaluating the effect of odors on nearby residences and the existing institutions, MWRA considered the effect of odors on potential recreational users. It was determined that there might be intermittent effects on neighbors at either site with a potentially substantial effect on recreators at Long Island Head, given the seasonal wind patterns and projected siting plans.

The use of covered tanks to mitigate odors was explored. The MWRA balanced the mitigating effect of covered tanks against the operation and management difficulties that had been experienced at other plants utilizing covers and also considered the additional cost required to employ covered tanks.

After reviewing odors and their potential impact on any of the sites considered, MWRA determined that odor control was a paramount concern in the design of the treatment plant and that stringent odor controls would be utilized no matter where the treatment plant was located. Having decided this, and having reviewed the odor impact information, MWRA concluded that odor and its control posed somewhat different problems at each island but balanced out sufficiently so as not to be a site-determinative issue between Long Island and Deer Island.

Odor impacts were found to have some significance, however, in the choice between all secondary options that retained the existing institutions and those secondary options featuring removal of the hospital or House of Correction. The options featuring retention of the existing institutions were considered less desirable because the ability to design the treatment plant with odor sources farther away from residential or recreational uses was substantially reduced at the more constrained sites. The retention of the institutions also increased the number of

persons impacted and degree of severity of impact with respect to the persons living, working or staying in the institutions.

Visual Effects

It was determined that a treatment plant on either island would have a negative impact on persons in the existing institutions due to proximity. With respect to residential neighbors, it was determined that if the institutions remained, there would be a greater negative impact from a treatment plant on Deer Island. If the House of Correction were removed, however, modifying landforms and landscaping could be used to screen the treatment plant from most residences.

Property Values

The effect on property values of the construction and operation of the treatment plant was addressed. Comparisons of affected communities with respect to fair market value, past appreciation, turnover rates and anticipated changes due to treatment plant construction and operation were reviewed. It was generally concluded that, no matter which site option was selected, property values probably would not decline during successful plant operation. However, there was discussion that there may be a decline of property values for communities near the treatment plant during construction but that these values would likely rebound fully after completion of construction. Also discussed was a projected possibility that property values around Deer Island might not fully rebound after construction. However, it was also deemed possible that the substitution of a carefully constructed and well-run treatment plant on Deer Island might raise values in the neighboring communities higher than they would be with the continuation of the existing plant operation. On the whole, property value impacts were determined not to be site-determinative, but a matter to be addressed through mitigation once a site was selected.

Health and Safety

Health and safety concerns of the community -- such as traffic impacts on schools and the elderly, chlorine delivery, air quality reduction from traffic or the facility operation -- were examined and not found to be site-determinative factors.

Summary of Effects on Neighbors

Most of the effects considered within each of the above sub-categories of effects on neighbors were found to be roughly equivalent when applied to the various site options. Although there were perceived imbalances of effects under some of the sub-categories, imbalances against one site under one sub-category tended to be neutralized by imbalances against another site in another sub-category. For example, imbalances found against the use of Long Island for either all secondary or mixed alternatives due to the additional cost of the traffic mitigation measures of repairing or replacing access bridges tended to balance out against the additional cost that might be required for noise mitigation on Deer Island, particularly if the House of Correction was not removed.

Similarly, the imbalance against Long Island caused by the determination that more substantial odor effect was likely on potential recreators was balanced against the possibility for greater negative visual impacts on residential neighbors from a treatment plant on Deer Island if the House of Correction was not removed. In sum, when all the effects were weighed within the sub-categories and the total effects of each sub-category were weighed one against the other, MWRA concluded that the criterion of effects on neighbors, as a whole, was not site-determinative.

3.2.2 EQUITABLE DISTRIBUTION OF REGIONAL IMPACTS

Equitable distribution of regional impacts was adopted by MWRA as an additional criterion in response to the issues of fairness raised in the comments on the SDEIS/DEIR. The criterion brought into the decision process considerations of how many and what kind of impacts a community might already bear from proximity to regional facilities other than the contemplated treatment plant. For example, impacts on Winthrop from Logan Airport, the Deer Island House of Correction and the current Deer Island treatment plant were reviewed, as were the effects on Quincy of the existing Nut Island treatment plant and flight patterns from Logan Airport. Distinctions were made between regional uses that provide little benefit to the community impacted (such as Logan Airport vis-a-vis Winthrop) and those regional facilities that daily serve a number of residents of the impacted communities (such as MBTA stations in Quincy). It was further noted that the impact from the latter use was mitigated by the existence of a local-aid fund which provides some monetary reimbursement to host communities.

The consideration of regional use burdens on potentially impacted communities had two applications in the preferred alternative siting decision. First, there was an assessment of whether or not the cumulative regional burdens on any one particular community would be so excessive if the treatment plant were sited nearby as to require, without regard to any other criteria, that the treatment plant be sited elsewhere. One decision maker concluded that the cumulative and long-term burdens imposed on Winthrop currently and in the past required a decision to site the treatment plant at a location other than Deer Island. Other decision-makers decided that the degree of unfairness did not rise to the level of unilaterally precluding the siting of the treatment plant on Deer Island.

The second way in which the criterion of equitable distribution of regional impacts was applied was to broaden the scope of factors to be considered in assessing effects on neighbors and in determining the nature and degree of mitigation measures to be undertaken. As to the former, the impacts of other regional uses were evaluated not only separately, for their effect on the community, but as they might combine with the noise, odor, and other impacts of the proposed treatment plant.

In assessing the impact of regional facilities on the various communities, MWRA concluded that the choice of any of the alternative site options was unfair to whichever of the communities were impacted, by virtue of the burdens to be borne by those particular communities on behalf of so many other communities. When contrasting the relative regional burdens between the impacted communities, some decision makers noted that the greatest share of burdens for

regional impacts was already borne by the City of Boston and that Boston's burdens would be increased whichever option was chosen. Between the City of Quincy and the Town of Winthrop, MWRA concluded that the greater number of regional burdens borne by Winthrop made it more unfair to Winthrop to locate the plant on Deer Island than it was unfair to Quincy to locate the treatment plant on Long Island.

3.2.3 COST

From the outset of its deliberations, MWRA considered cost to be an important criterion. One of the first tasks MWRA undertook was to closely examine the previous cost estimates which had been included in the 1982 MDC Site Option Study and the SDEIS/DEIR. Those cost estimates and a new set of estimates prepared by MWRA's consultant were analyzed and discussed both as to the absolute dollar figures presented and as to the relative differences in costs between sites.

Following the initial presentation to and discussion of these figures by MWRA, consensus was reached by the various cost estimators which reduced the range of difference among them by half. The MWRA reviewed the original figures, the new figures, the basis for each and the rationale for the differences. It recognized that the figures could be firm to only a certain degree, given that a site was being selected prior to any facility design being undertaken. The MWRA chose to consider the higher figures in the range as better representing the most conservative case for design and construction needs and choices, including but not limited to greater assurances of reliability through increased redundancy and mechanical backup.

At each stage of development of the cost figures, MWRA determined whether the differences changed the ranking or rating of the site alternatives or the relative differences between the alternatives appearing in the SDEIS/DEIR. As to the first two stages of development in cost estimates described above, MWRA concluded that the ranking or rating of alternatives remained the same and the relative difference between the sites remained constant no matter which estimates at which level of refinement were used.

However, as the deliberations of MWRA with respect to the other criteria continued, it became evident that cost was closely intertwined with assessments of those criteria and constituted an important factor for each item evaluated. As a result, further discussion and inquiry on costs were undertaken by MWRA, and a third and more detailed cost analysis was produced. The resulting figures were reviewed and discussed by MWRA. It was determined that while the new figures narrowed the difference in cost between some of the options involving Long Island and some of the options involving Deer Island, it did not change the ranking of any of the site alternatives.

The MWRA also developed and discussed a comparison of costs between Deer Island and Long Island with and without the existing institutions. The MWRA concluded that in all cases, it was less costly to construct the treatment plant on Deer Island as compared to constructing it on Long Island. It further determined that it was less costly to construct the treatment plant on either of the islands without the respective existing institutions being present.

3.2.4 IMPLEMENTABILITY

The MWRA utilized the implementability criterion to assess how quickly and how predictably the treatment plant could be completed at each of the alternative sites. This included a review of the requirements for and potential impediments to obtaining the real estate necessary for the construction of the treatment plant under the various alternatives. After examining the ownership and the means by which that ownership could be transferred, MWRA concluded that obtaining the required land under all the options was roughly equal in terms of the legal steps to be taken and the likelihood of success.

The MWRA also reviewed the various permits, licenses and approvals that would be required from federal, state and local authorities in order to build the treatment plant under the various site plans proposed. It found that most of the state and federal permits required were equally applicable to Deer Island and to Long Island. It noted that burial grounds and archaeological/historical properties were a significant issue with respect to Long Island and would probably require extensive mitigation efforts, but also took into account that Deer Island had historic resources that might require consultation with authorities and possible mitigation. Similarly, MWRA examined the conclusion of the SDEIS/DEIR that the permit issues surrounding burial grounds principally impacted Long Island, but also noted the possibility that they might be involved with Deer Island as well. With regard to the loss of historical or archaeological resources, MWRA gave weight to the fact that the necessary consultation, mitigation and approval process for whichever island was selected could be engaged in concurrently with the facility planning and design process for the treatment plant, and would not greatly delay the construction of the facility. It was also considered important that this approval process, while requiring consultation and mitigation, could not prohibit the construction of a treatment plant on either island.

Further implementability issues that might apply to only one of the islands, or might be more difficult on one island as compared to the other, were examined. These included wetlands, order of Conditions, bridge construction, barrier beaches, opening of Shirley Gut, air quality questions, possibility of contaminated dredge spoils, existing grit and screenings, hospital relocation and House of Correction relocation. The first three of these issues were thought to have more certain application to Long Island but were considered to have possible application to Deer Island as well. The middle three issues were looked at as possibly raising additional or more difficult issues in the case of Deer Island. Air quality issues were discussed with EPA, and further information obtained by the EPA indicated to MWRA that the treatment plant could be located at either island without violating national ambient air quality standards for air pollution under the configurations being considered by MWRA and by EPA.

Implementability of relocating the existing institutions on Deer Island and Long Island was scrutinized very closely by MWRA. The MWRA heard and considered presentations by legal counsel to the City of Quincy and the Town of Winthrop on the need for and comparative legal difficulty of relocating the institutions. The MWRA also received and evaluated communications from the Governor of the Commonwealth, the Mayor of the City of Boston and the Speaker of the Massachusetts House of Representatives. The MWRA concluded that, as to real estate and permit approval issues, the various site options balanced out with respect to implementability. The

removal of the House of Correction from Deer Island, however, was felt by MWRA to be more feasible than removal of the Long Island Hospital, considering the commitments made by the authorities who would be in a position to implement the respective relocations.

3.2.5 RELIABILITY

The MWRA viewed reliability as the concept of enhancing the overall integrity of the waste treatment system. Information was received on such factors as minimization of detrimental consequences of outages, operational capabilities during and after construction, managerial enhancement and technological reliability. Particular issues of reliability were explored in more detail. The performance of a secondary treatment system was reviewed at some length with stress on the need for proper design to handle such things as variable loads and intake of septage to prevent a malfunctioning of the system which would result in partially treated sewage being released into the harbor through a short outfall. The reliability of tunnels was reviewed, and the use of round versus rectangular clarifiers was discussed. Also considered was the need for backup in the case of catastrophic outages.

With regard to clarifiers, the Board heard that circular clarifiers were considered more reliable by some and that use of those clarifiers would require a greater acreage and expenditure to install, but it also heard that a comparable degree of reliability could be provided by rectangular clarifiers, which use less space and are less costly. The MWRA determined that either type of clarifier could be utilized under the various site options being considered.

The greater or lesser use of tunnels under any particular site option was considered to be an insignificant factor since it was determined that reliability of tunnels could be assured through proper design and maintenance during construction and operation. There was a recognition that those site options with split plants would provide greater reliability in the case of catastrophic outages, but this fact was determined to be offset by the consideration that such outages could be expected to occur at very infrequent intervals and that the ability to achieve reliability at split plants would be more costly because of the need to provide two sets of administration and staffing.

In assessing the various site options in light of reliability factors, MWRA concluded that, while reliability was a very important consideration in constructing and operating the wastewater treatment plant, it was not a determinative factor in selecting site options between Long Island and Deer Island. Reliability was viewed by MWRA, however, as a very important factor in its relationship to impact on neighbors. Any reduction of efficiency or increase in operational malfunctions would potentially create greater negative impacts, such as odors, on the neighborhood. It was also recognized and considered an important factor that the capital cost of the secondary treatment plant would be greatly increased by the design and engineering which would be necessary to protect against the greater unreliability inherent in a constrained site. Also, higher operational and maintenance costs would have to be anticipated as a result of the more complex design that would be required.

Weighing all these factors, MWRA concluded that greater reliability would be obtained in any of the secondary treatment plant options if the respective existing institutions were removed and,

conversely, that reliability would be severely impacted if the secondary treatment plant was built without removing the respective institutions. In any other regard, reliability was considered to be equally obtainable at all site alternatives considered and therefore not site-determinative.

3.2.6 HARBOR ENHANCEMENT

The MWRA's view of harbor enhancement incorporated compatibility of the proposed treatment plant with attainment of the harbor's potential. The MWRA reviewed the site alternatives not only with respect to how each site option might serve as a source of impact on the Harbor but also as to how each option might serve as an opportunity for achieving the objectives listed. This information for the site options -- as they related to one another and to the Harbor as a whole -- was then considered.

Certain concerns of MWRA were further explored. The potential for recreational use of Deer Island was reevaluated and discussed. As a result, MWRA accorded greater weight to the recreational potential of Deer Island than had been previously assigned to it in the SDEIS/DEIR. The MWRA concluded that the recreational potential of Deer Island and of Long Island, absent any development, was similar in a number of ways with many of the same types of activities potentially available. Two differences were found to favor the preservation of Long Island's recreational potential, however. The first was the greater potential for public swimming beaches at Long Island. The second was the wilderness experience derived from the wild vegetation in the undeveloped parts of Long Island which, once destroyed, could not be recreated elsewhere.

The two islands were also reviewed for compatibility of recreational use with a treatment plant present. If the existing hospital were retained along with the treatment plant, Long Island would lose the significant recreational potential of Long Island head but might retain its barrier beaches, whereas if the existing House of Correction were retained, Deer Island might be able to encompass a small naturalized park located at Deer Island head. If neither existing institution remained along with the treatment plant, a park at Long Island head and an environmental study area in the southwest of Long Island could possibly be preserved, while at Deer Island, a neighborhood park and a regional park could be created and the natural beaches preserved.

It appeared to MWRA that the quality of recreation on the islands -- co-existent with a treatment plant but without the existing institutions -- was higher for Deer Island than Long Island. At Deer Island, existing or man-made landforms could screen recreational areas from nearby receptors. At Long Island, the treatment plant would be highly visible, and the wind patterns might carry the odors over Long Island head a significant amount of the time. In balance, MWRA felt that greater recreational potential for the harbor would be available by building the treatment plant on Deer Island rather than Long Island with or without the existing institutions, but particularly in the latter case.

The MWRA also considered implementability of recreational plans. It was noted that Long Island was physically ready to be developed for recreational use almost immediately if no treatment plant were sited there, but that a much longer time would elapse if recreational use had to wait until a treatment plant was operational on Long Island and the Deer Island treatment plant subsequently removed. The availability of funds for recreational development of Long Island as an already established priority in the Boston Harbor Islands Park system enhanced the likelihood of recreational development of Long Island in the near future.

In assessing the visual effect of the various treatment plant site options, it was determined that the primary and secondary treatment plant options at Long Island were deemed to produce the most radical changes to the natural terrain and to impact the most negatively on the harbor as a whole.

Having reached the above conclusions and having evaluated the information contained in the SDEIS/DEIR, the MWRA concluded that harbor enhancement would be promoted by the preservation of Long Island as a potential park resource and, conversely, that the harbor would be diminished both visually and for recreational purposes, if the treatment plant were constructed on Long Island.

3.2.7 EFFECT ON NATURAL AND CULTURAL RESOURCES

The MWRA examined the natural and cultural resources that would be impacted by each of the site option alternatives. In addition to the information contained in the SDEIS/DEIR, summaries further distilling the information and updated reports of ongoing evaluations of the sites by the Massachusetts Historical Commission were heard and evaluated. The MWRA not only considered the number and significance of historical, cultural and archaeological structures and sites, but also the degree of mitigation that might be required if such places and things were disturbed. The possible effect of any mitigation measures on duration and cost of construction was then assessed. The MWRA also gave some weight to the nomination or intended nomination of those items to the National Register of Historic Places.

The MWRA took into account the number of archaeological sites in existence, the rarity and integrity of such sites, the contribution of such sites to an understanding of our history, and the quantity of material contained in the sites. It was noted that no archaeological sites had been uncovered at Deer Island, but MWRA also took into account that there had not been as thorough a survey of parts of Deer Island as there had been for the whole of Long Island. Nevertheless, in reviewing the five prehistoric sites uncovered at Long Island, MWRA determined that their preservation deserved stronger consideration in the choice of a site.

With regard to cemeteries, MWRA contrasted the existence of several cemeteries on Long Island with the possible existence of a cemetery on Deer Island. Again, however, it noted that Deer Island had not been as intensively surveyed as Long Island. It noted that Long Island in its entirety was being considered for nomination as part of the Boston Harbor Archaeological District. The MWRA concluded that the existence of cemeteries was not as significant as the existence of archaeological sites since the cemeteries could be moved and preserved elsewhere.

Although the movement of graves raised implementation issues, those issues were the same for each island and were not considered to be impossible to overcome.

The MWRA also reviewed the potential eligibility of the Long Island Hospital, the Deer Island House of Correction, and the Deer Island Pumping Station for listing on the National Register of Historic Places.

Finally, MWRA reviewed the natural resources of the two islands. While little or no adverse impacts to the natural resources on Deer Island were found, with the exception of the removal of the drumlin on Deer Island in the case of a secondary treatment plant being sited there, it was determined that the wetlands and barrier beach at Long Island might be adversely affected by the construction of either a primary or secondary treatment plant even if strict controls were imposed. Concern was expressed that even a split secondary option would impact on sensitive areas on Long Island. In summary, MWRA concluded that the least negative impact on natural resources would be achieved by selecting Deer Island for an all-secondary or all-primary wastewater treatment plant.

3.2.8 MITIGATION MEASURES

The MWRA used the criterion of mitigation measures to focus on and clearly consider those actions which might be or ought to be taken with regard to a particular site to make that siting choice environmentally acceptable, and to assure to the greatest extent feasible that negative impacts from the siting selection would be alleviated or compensated for. The MWRA considered both environmental and non-environmental measures.

Environmental Mitigation

Environmental mitigation measures were considered to be those steps which would minimize adverse impacts from the construction and operation of the treatment plant.

Construction impact mitigation measures reviewed included barging, land modifications and buffers, scheduling and specifications for equipment to reduce noise impact, and monitoring and response mechanisms to oversee and enforce construction mitigation efforts.

Operations-impact mitigation measures examined included the use of technology, design and buffers to reduce noise, odors and visual impacts on residences, institutions and/or recreators, as well as adaptation of site layouts and monitoring mechanisms to ensure proper operation and maintenance of the treatment plant and to assure responsiveness to changing conditions.

Most of the environmental mitigation measures were explored not only separately but as part of discussions involving reliability, effect on neighbors, cost, site layouts and effect on natural and cultural resources and are addressed to varying degrees under each of those topics in the FEIR. The MWRA articulated throughout these discussions a strong commitment to environmental mitigation, particularly as it would reduce negative impacts on the nearby receptors. It also recognized, however, that the extent of the mitigation employed would be

determined, in part, by balancing the cost to the ratepayers against the degree of mitigation to be achieved. In some cases a determination was made that certain amounts or kinds of mitigation would be undertaken regardless of cost. For example, it was decided that stringent odor controls would be employed no matter where the treatment plant was constructed. It was also determined that a significant degree of barging was required for the transportation of construction equipment and materials.

Most of the environmental impact measures considered were deemed applicable in some degree to all sites, but some measures were found to be required more frequently or to a greater degree under one site option or another. For example, the environmental mitigation measures to be employed when disturbing cultural or natural resources were perceived to be required more often and to entail more effort at Long Island than at Deer Island due to the greater number and value of sites located at Long Island. Balanced against this was the greater impact of noise on Deer Island neighbors and the resulting need for additional mitigative measures. The MWRA concluded that the individual environmental mitigation measures or the degree to which those measures might need to be applied differed from site option to site option but that, when all the mitigation measures for a particular site were totaled and balanced against all the mitigation measures required for another site selection, the environmental mitigation measures tended with one exception to balance out and not to be site-determinative. The exception pertained to the split plant options which would require the implementation of mitigation measures at two sites instead of one, with a substantial increase in cost. The MWRA considered this a factor to be weighed against selection of the split plant options.

The MWRA did decide that mitigation measures, while not being site-determinative between all Deer Island and all Long Island, were of critical importance with respect to whichever site it chose. Consequently, MWRA voted just prior to selecting its tentative preferred alternative site, that its FEIR for siting the Harbor Islands treatment plant should include a complete discussion of all practicable means and measures to minimize damage to the environment in connection with construction of the new sewage treatment facility including but not limited to: (i) barging of construction material and personnel, (ii) limitations on unnecessary construction period traffic, (iii) controls on construction noise, (iv) controls on operating noise and odors, (v) visual enhancements of the site, (vi) alternatives to through-neighborhood trucking of chlorine for purposes of facility operations, (vii) construction of deep ocean outfalls, and (viii) development of compatible recreational uses on the site and elsewhere in Boston Harbor. The Board also voted on the day it made its tentative preferred alternative selection that it preferred that sludge management facilities be located off-site from the treatment facility.

Non-Environmental Mitigation

The MWRA considered non-environmental mitigation to be an important consideration in the siting decision and a necessary adjunct to the construction of a treatment plant of the size and complexity planned. Non-environmental mitigation measures examined were the opening of Shirley Gut, which would physically isolate Deer Island from the mainland, rehabilitating or reconstructing access bridges, development of recreational or other multi-use possibilities for the sites considered, protection against future facility overload, assurances of plant operating performance, employment of innovative technology, and relocation of the existing

institutions. With respect to the measures reviewed, the ones determined to be site-specific were those concerning access bridges, opening of Shirley Gut, and relocation of the existing institutions.

As discussed in the text regarding the criterion of effect on neighbors, MWRA evaluated the comparative difficulty and cost regarding rehabilitation or replacement of access bridges and determined that it would be more costly to repair, replace or construct new bridges for access to Long Island.

After examination of the geologic processes and currents affecting Shirley Gut, the need for and high cost of maintenance to keep the Gut cleared, the numbers of regulatory requirements for undertaking such a project and the possibility that its being opened would result in greater nearshore pollution and perhaps permit movement of polluted waters from Boston Harbor through the gut to the eastern shores of Point Shirley and Winthrop, the MWRA determined that the opening of Shirley Gut was not a feasible mitigation measure and that other means of separating Deer Island from the mainland should be considered if a need for separation were determined necessary or desirable.

The relocation of the existing institutions was determined by MWRA to be a critical non-environmental mitigation measure. This conclusion resulted from the MWRA's evaluation of: the effects of noise, odor and visual aspects of the treatment plant on the persons working in or inhabiting the institutions; the reduction in reliability which would result from construction of the treatment plant on sites constrained by the presence of the institutions; the far greater construction cost and ongoing maintenance and operational costs which would result from having to construct the treatment plant on a constrained site; and the greater recreational potential which would be available for the harbor if the institutions were removed. With respect to cost, recreational potential and the effects of noise, MWRA concluded that it was even more important to relocate the House of Correction than the Long Island hospital, since the negative impact from retaining the existing institution on the same site as the treatment plant was greater for Deer Island than for Long Island. The MWRA also determined that while regional impacts would be more equitably distributed by the relocation of either institution, more equitable distribution would result from the relocation of the House of Correction due to the nature of the respective institutions and the number and kinds of regional impacts already experienced by the Town of Winthrop. The MWRA further noted that property values were more likely to be increased in the Town of Winthrop by the removal of the House of Correction than those in the City of Quincy by the removal of the hospital, and that the health and safety of residents of the Town of Winthrop were apt to benefit by the relocation of the House of Correction.

In summary, the MWRA concluded that if either Long Island or Deer Island were selected, the existing institutions should be relocated. As between the two islands, MWRA decided that it was more important and more beneficial to remove the House of Correction if Deer Island were selected than it was to relocate the hospital if Long Island were selected. Some decision makers felt that if Deer Island were selected, the House of Correction must be relocated. For these decision makers, the relocation of the House of Correction was not a mitigation matter but an action compelled by the other criteria.

In evaluating the removal of the institutions, MWRA placed strong emphasis on the implementability of such a measure. It received and considered commitments made by those authorities empowered to and responsible for any such relocation and determined that the implementability of relocating Deer Island House of Correction was likely -- far more likely than relocating the hospital.

As with environmental mitigation, MWRA indicated its strong commitment to non-environmental mitigation by voting for the preparation of a complete discussion, for use by the Board of Directors, of proposed non-environmental mitigation measures for the construction of the Harbor Islands treatment plant including, but not limited to, construction workforce hiring preferences for residents of impacted communities, protection against diminished real estate values from nearby construction activities, preferential economic considerations for impacted communities, and funding for repair of bridges, roads or other physical infrastructure damaged by construction activities.

3.2.9 CRITERIA WEIGHING PROCESS

The MWRA concluded that while all the criteria were important, some criteria were of relative equivalent value when applied to the various site options and were not site-determinative. Those criteria were: reliability, effects on neighbors, and implementability, as well as the environmental mitigation part of mitigation measures.

The five criteria which MWRA concluded were site-determinative were: cost, equitable distribution of regional impacts, harbor enhancement, effect on natural and cultural resources, and non-environmental mitigation. All the site-determinative criteria except equitable distribution of regional impacts weighed in favor of selecting Deer Island as the site for the wastewater treatment plant. While the considerations of fairness implicit in the equitable distribution of regional impacts were valued very highly by MWRA, they were not sufficient, by themselves, to outweigh the considerations of cost, harbor enhancement, effect on natural and cultural resources, and non-environmental mitigation measures.

In addition to determining which island should be the site for the construction of the Harbor Islands wastewater treatment plant, MWRA concluded that whichever island was chosen, any existing institutions on that island should be removed. It based that conclusion on the results of applying the criteria of reliability, cost, harbor enhancement, effects on neighbors, and mitigation measures. Furthermore, MWRA found on the basis of cost, equitable distribution of regional impacts, effects on neighbors (health and safety)*, harbor enhancement, implementability, and mitigation measures (non-environmental) that Deer Island without the House of Correction was the best site configuration considered. For some decision-makers, these latter criteria compelled the conclusion that if Deer Island were to be chosen as the site for the treatment plant, the House of Correction had to be removed.

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* While health and safety issues originating from the construction and operation of a wastewater treatment plant were found not to be site-determinative, health and safety were considered to be enhanced by the removal of the House of Correction.

3.2.10 TENTATIVE SELECTION

On July 9, 1985, on the day prior to its selection of a preferred alternative site, MWRA voted its determination that the cost of a new wastewater treatment facility would be enhanced if the facility could be constructed on a site unrestricted by another existing institution, and that the removal of any existing conflicting institution would effectively serve to mitigate the impact of the location of a new wastewater treatment facility on surrounding communities.

In addition, MWRA voted to direct its staff to work with any and all elected or appointed officials for the purpose of expediting the removal and relocation of any other institution located on whichever island it ultimately designated as the preferred alternative site for the new wastewater treatment facility. It further instructed its interim Executive Director to take certain actions to implement its position.

On July 10, 1985, the Board of Directors of the Massachusetts Water Resources Authority, in two separate votes, each ten to one, designated Deer Island as its preferred alternative for the siting of a new primary treatment wastewater treatment facility and as its preferred alternative for the siting of a new secondary treatment wastewater facility for Boston Harbor. The designations were explicitly undertaken for the purpose of completing final environmental and other precommencement review and to serve as the basis for undertaking only such additional work in the nature of planning, design, site assembly and any other work as can be accomplished prior to the availability of the Final Environmental Impact Report.

3.2.11 FINAL SELECTION

The following is the text of G.L.C. 30 Section 61, Findings by the MWRA on the Selection of Deer Island as the Site for Wastewater Treatment Facilities in Boston Harbor.

> On February 3, 1986, the MWRA made its final selection of a site for the proposed harbor island wastewater treatment plant. The selection of Deer Island as the location for the new facility brought to a close eight years of evaluation, discussion, comment and refinement of siting issues. Most of the history of the process followed and information explored is contained in the Supplemental Draft Environmental Impact Statement/Draft Environmental Impact Report (SDEIS/DEIR) and the MWRA's Final Environmental Impact Report on the Siting of Wastewater Treatment Facilities in Boston Harbor (FEIR).
>
> In particular, the latter document details the decision process engaged in by the MWRA from its inception in early 1985 through to its tentative selection of Deer Island as the site for the wastewater treatment facilities in July, 1985. Since July, the MWRA has continued to gather information which it has published in the FEIR, has received and evaluated comments to the FEIR including the Secretary's Certificate of Adequacy, and has reviewed EPA's Final Environmental Impact Statement and comments submitted on that document. Based on this information and on its previous examinations and evaluation, the MWRA has made its final selection. The following sets forth the findings upon which that final site selection rests and the process by which it was completed.

DECISION PROCESS

In addition to its prior deliberations leading to the tentative selection of Deer Island as a site for the harbor island treatment plant, the MWRA evaluated two new categories of information in making its final siting selection. The first, technical information collected or refined between the July 1985, decision and the publication of the FEIR, was presented to and discussed by the MWRA Board of Directors at a series of public board meetings held throughout the fall of 1985. During these meetings, the MWRA reviewed and approved the content of the FEIR and adopted commitments to major mitigation measures contained in that document.

The second category of information reviewed by the MWRA was public and official comment to the FEIR, including the Certificate of Adequacy issued by the Secretary of the Executive Office of Environmental Affairs. In addition, the MWRA staff reviewed the Environmental Impact Statement issued by the Environmental Protection Agency and the Board of Directors reviewed the comments to that document as well as a summary of relevant distinctions between the FEIS and FEIR.

The information thus gathered was then evaluated for its applicability to the method of decision-making to be used in the final selection, for the effect of the information on the application of decision criteria to site options and for its effect on the mitigation measures to be adopted by the MWRA. A summary of that evaluation follows.

DECISION-MAKING METHOD

Selection of Criteria

The MWRA chose to maintain the eight criteria utilized in its tentative site selection process: Reliability, implementability, harbor enhancement, impacts on cultural and natural resources, costs, effects on neighbors, mitigation and equitable distribution of regional responsibilities. These criteria had been selected originally by the MWRA in response to the decision process carried out through the SDEIS/DEIR and the comments on that process. The Secretary of Environmental Affairs ("Secretary"), in his Certificate of Adequacy on the FEIR ("Certificate") approved the use of Equitable Distribution of Regional Responsibility as a means of assessing the more emotional, unquantifiable aspects of siting but opined that mitigation was better addressed only after a siting selection and not as a part of the siting decision process. As to the latter, the MWRA found that the use of mitigation as a criterion in arriving at a site selection had served a useful purpose and had contributed a focus different from the discussion of mitigation after a site was selected and that it was better to continue the decision process as already begun rather than making a major shift in the use of criteria at the culminating point in the decision process.

Weighing of Criteria

The Secretary's Certificate on the FEIR had recommended that each criterion be assigned a relative importance in the final decision. The MWRA reviewed the eight criteria selected and determined that they should be given equal weight as compared to each other.

Site Options

The MWRA, in reviewing the information gathered in light of the criteria utilized, found that a number of earlier determinations made in its tentative decision process should remain intact. Some of these determinations, once confirmed, served to eliminate certain site alternatives from consideration. For example, the MWRA confirmed its earlier tentative site decision that Nut Island was unacceptable for the construction of a treatment plant of the size contemplated, particularly with the filling of Quincy Bay which would be required. The Secretary's Certificate had acknowledged and found this conclusion to be acceptable, and other comments had only served to support this position.

The MWRA also confirmed its tentative decision that the four split plant options be rejected on the grounds that only the criteria of reliability and equitable distribution of regional impacts favored the selection of any of the split plant options, while the concerns encompassed in the remaining criteria were adversely affected by those alternatives. For example, the split island options would be more costly to construct, operate and maintain; would cause aggravated impacts to a wider universe of neighbors -- thus causing the need for greater mitigation; would be more difficult to implement because of the need to obtain approximately twice as many permits; and did not significantly lessen the impact of single island alternatives on cultural or natural resources or harbor enhancement. There was no additional or different information presented to persuade the MWRA to change this position.

As a result of these findings concerning site alternatives, the MWRA was left with a comparison of all Long Island and all Deer Island as possible sites for the harbor facility. A summary of the analysis of these two site alternatives in light of each of the criteria used and the information gathered as it affected those criteria, and the conclusions reached, follows.

APPLICATION OF DECISION CRITERIA TO THE ALL LONG ISLAND AND ALL DEER ISLAND SITE ALTERNATIVES

CRITERIA WITH NO SITE DETERMINATIVE EFFECT

In examining Long Island and Deer Island in light of the eight criteria, the MWRA found two criteria, reliability and effects on neighbors, to be of relatively equivalent value and therefore not to be site determinative.

Reliability

The MWRA had previously found reliability to be non-site determinative in its tentative decision because the size and configuration of each of the islands presented the same potential for use of design and layout to provide for reliability of the waste treatment system. The MWRA, in its current evaluation on reliability, noted that no new information had been presented to change that determination and confirmed its earlier decision.

Effects on Neighbors

The MWRA also found the effects on neighbors to be roughly equivalent between the two islands. As before, effects on neighbors were reviewed in six components: traffic impacts, noise impacts; odor impacts; visual impacts; property value impacts and safety impacts.

Traffic

Following its initial determination that the traffic impacts were comparable between the two sites, the MWRA commissioned a study to augment information provided in the SDEIS/DEIR traffic analysis. This analysis examined roadway conditions, assembled traffic counts, determined the present level of service on the roadways (LOS), and evaluated the impact of expected construction traffic. The MWRA concluded that for the predicted level of construction related traffic there was sufficient roadway capacity leading to each site during peak hours and that the impact although somewhat worse at some intersections for access to Long Island, was relatively comparable.

The MWRA also further explored the feasibility of barging, identifying the types of barging and/or water transportation that might be needed and sites that could be utilized. The MWRA made commitments to a level of barging, to caps on construction-related traffic and to busing of workers, all of which is set out in the Commitments to Mitigation section below.

The MWRA reviewed traffic-related comments received on the FEIR. The MWRA concluded, based on its original evaluation and the additional traffic information and comments collected since its tentative decision and its strong commitment to mitigation measures, that the traffic impacts remained roughly equal and did not favor either island.

Noise

The MWRA, in its tentative decision, adopted the then current position of EPA that noise levels at Deer Island would result in greater impact to neighbors, particularly the close neighbors at the House of Correction. However, that position was predicated on EPA's view that Long Island as a site for the treatment plant could not contain the Long Island hospital whereas the Deer Island site could encompass the House of Correction.

The MWRA in its final selection compared the sites equally, i.e. both sites with existing

institutions and both sites without those institutions. The MWRA concluded that when the sites without institutions were compared, there was more noise impact on neighbors at Deer Island than at Long Island. If the sites were compared with the institutions present, then the severity of impact on the residents or workers at each institution was equivalent.

To explore whether noise levels at Deer Island could be kept at acceptable levels, the MWRA retained an acoustical consultant to evaluate expected noise levels during both construction and plant operation for the Deer Island site. The consultant also furnished information to the Board on existing acoustical conditions, applicable regulations and an evaluation of the expected effectiveness of noise mitigation measures.

The MWRA concluded that for the nearest residence the noise levels from both construction and operation were within applicable legal standards. Furthermore, during the daytime the projected noise would be indistinguishable as compared to the existing ambient levels. At night, with a minimum of construction to be anticipated, nighttime noise would not be an impact. During plant operation, if power was generated on-site, a slight increase in background levels over existing levels was determined to be likely.

Based on this information and upon review and assessment of comments on noise, the MWRA concluded that while noise impacts upon receptors other than the current institutions would be greater at Deer Island, those impacts could be maintained at acceptable levels. The MWRA also found that the noise impacts at Deer Island prison or Long Island Hospital, because of the proximity of those institutions, would raise the noise levels above the legal standard and would require extraordinary mitigation measures to be adopted.

Odor

Odor studies conducted on behalf of the EPA have indicated that potential odor impacts on neighbors are comparable, regardless of plant location. This confirmed the MWRA's tentative decision that the issue of odor was not site determinative. The MWRA further recognized that odor control was a paramount concern and that stringent odor controls would be utilized no matter where the treatment plant was located. As a result of further work presented since its tentative selection, the MWRA concluded that control stystems such as wet scrubbers and carbon absorption columns would likely be effective in controlling the odors. The MWRA confirmed its tentative decision that odor impacts were not site determinative and committed itself to a limit of no detectable odor off-site as well as a goal of no objectionable odor on-site.

Property Values

Reviewing trends in real estate values and the impacts of other noxious facilities on property values, the MWRA confirmed its tentative decision that the effect on property values, to the extent that that effect could be predicted, was not site-determinative.

Visual Impacts

In its tentative decision the MWRA determined that a treatment plant on either island have a negative impact on persons in the existing institutions due to proximity. With respect to residential neighbors, it was determined that if the institutions remained, there would be a somewhat greater negative impact from a treatment plant on Deer Island. If the House of Correction were removed, however, modifying land forms and landscaping could be used to screen the treatment plant from most residences.

Health and Safety

Health and safety concerns of the community -- such as traffic impacts on schools and the elderly, chlorine delivery, air quality reduction from traffic or the facility operation -- were examined and found once again not to be site-determinative factors.

Summary of the Effects on Neighbors

Most of the effects considered within each of the subcategories of effects on neighbors were found to be roughly equivalent between Long Island and Deer Island. For those two categories in which a somewhat more negative impact was discerned for Deer Island, noise and visual impact, the degree of difference in impact was not sufficient to change the balance of effects on neighbors between the two sites.

SITE DETERMINATIVE CRITERIA

The MWRA found the remaining six criteria to have a site-determinative effect. Five of the criteria favored the selection of Deer Island while one criterion, equitable distribution of regional responsibilities, favored the selection of Long Island. A summary of that analysis follows.

Equitable Distribution of Regional Responsibility

Just as in its tentative decision, the MWRA found in its final site selection that this criterion favored the selection of Long Island over Deer Island. The impacts of other regional uses such as Logan Airport, Deer Island House of Correction and the current Deer Island treatment plant were found to have greater impact on Deer Island neighbors than the airport and other regional facilities had on Long Island neighbors. The MWRA concluded that it was more unfair to site the harbor facility at Deer Island.

Cost

The MWRA again found this criterion to favor selection of Deer Island. There was no change to the cost information upon which the MWRA had made its tentative decision. Those figures still showed the construction of a treatment plant on Deer Island to be less costly than a facility at Long Island. While noting that EPA had found this criterion to

be non-site determinative and that the Town of Winthrop had concurred with this conclusion, the MWRA recognized that this reflected a value judgment by the EPA and Winthrop of the relative unimportance of the dollar difference which both EPA and MWRA agreed existed rather than different information as to the cost figures themselves. The MWRA, as the operator of the system felt that the difference in cost between the two sites was of site significant importance.

Implementability

In its tentative decision, the MWRA found implementability to be non-site determinative. The information which the MWRA had reviewed at that time covered the permitting and land acquisition issues and, based on the assessment that the numbers and types and timing considerations of permits and approvals were generally the same, had concluded that the criterion was relatively equivalent between the sites. The MWRA also noted at that time that the removal of the House of Correction from Deer Island was far more implementable than the removal of the hospital from Long Island due to the expressed support for the former by those in a position to effect the removal.

Two factors have been added to the implementability discussion since the tentative decision, however, which have caused the MWRA to change its conclusion about this criterion. The first is the concurrence in the approval by the Secretary of the selection of Deer Island as the site for the treatment plant. The second is the selection of Deer Island by the EPA as its preferred alternative. The choice of Deer Island as the preferred site by both a state regulator and a federal regulator, each of which has responsibilities in further permitting or approvals concerning the construction and operation of the treatment plant and related facilities, increased the likelihood of successful and expeditious processing of the many regulatory reviews and permits pertaining to the Deer Island site. It also suggests a facilitating of the disposition of federal land located on Deer Island. In light of these factors, the MWRA has found in its final siting decision that implementability is no longer non-site determinative and that it weighs in favor of selecting Deer Island.

Harbor Enhancement

A further exploration into recreational potential of Deer Island conducted during the tentative decision process was completed for the FEIR and confirmed what had already been suggested during the tentative decision process: that a greater potential existed for Deer Island than had been suggested in the SDEIS/DEIR. However, the possibility of this greater potential had been discussed when the MWRA made its tentative selection and its confirmation did not change the MWRA's determination that harbor/enhancement favored siting the treatment plant at Deer Island. The MWRA still found that Long Island's recreational resources included natural and undeveloped aspects which could not be recreated if lost; that Long Island as a park could be brought to reality sooner since it did not have sited on it both a prison and a current treatment plant which had to continue operating until the new plant was on line; that there were indications that official support and dollars had already been or could readily be

mobilized to make a park on Long Island a reality; and, finally, that the adverse visual impact on the harbor was greater from a treatment plant on Long Island because of the Island's position in the harbor and its configuration.

Effect on Natural and Cultural Resources

In examining the natural and cultural resources of each island, the MWRA took into consideration additional pieces of information received since its tentative decision. In particular, the MWRA considered the results of a study, which it had commissioned, of parts of Deer Island which had never been adequately evaluated before for the existence of archaeological or historical resources. That study confirmed the existence of a cementery in the northeastern part of the island and also confirmed the potential eligibility of the Deer Island pump station and portions of the Deer Island House of Correction complex for nomination to the National Register. Subsequently, the Massachusetts Historical Commission found that the pump station, and two buildings in the prison complex met National Register criteria. In its comments on the FEIS, the Commission also noted that Long Island in its entirety had been nominated to the National Register as a component of the Boston Harbor Islands Archaeological District, that the Long Island hospital complex also met National Register criteria of eligibility and that historic burial grounds existed on Long Island.

All the information received concerning these resources was a confirmation of material already considered to be potentially true during the MWRA's tentative decision. The MWRA found, as it had in its tentative selection, that Long Island possessed more resources and more unique resources than Deer Island and that these resources, particularly the unique resources, would be adversely impacted by the siting of the harbor treatment plant facility on Long Island.

The MWRA noted that EPA had found this criterion to be non-site determinative but recognized that EPA had hypothesized layouts which could avoid these resources without fully exploring the technical feasibility of those layouts. The MWRA had assured that the layouts upon which their conclusions rested were technically feasible.

Mitigation

The MWRA utilized the criterion of mitigation to focus on and clearly consider those actions which might be or ought to be taken with regard to a particular site to make it more acceptable. The utilization of this criterion in the siting decision process brought to the fore and highlighted mitigation measures which might be site specific and permitted the MWRA to weigh the need for those measures in its siting selection. Early analysis of mitigation needs during the decision process also laid the groundwork for a thorough understanding and appreciation of mitigation measures to be adopted once a site was chosen. The mitigation measures to which the MWRA finally committed itself in the implementation of its site selection of Deer Island are contained in the Commitments to Mitigation section which follows.

With respect to the effect of the mitigation criterion in the siting selection process, the MWRA confirmed its earlier finding that mitigation favored the selection of Deer Island.

While various measures to mitigate construction and operation impacts such as noise and odor or the destruction of natural or cultural resources might shift the balance slightly toward one site or the other within each of those categories, the total number of kinds and degree of mitigation required for one site or the other tended, with one exception, to balance out roughly equal as a whole. The one exception was the mitigation measure of relocating the existing institutions. The MWRA found in its tentative decision and confirmed in its final decision that it was critical to relocate whichever existing institution was located on the chosen site due to the adverse environmental effects which accrued from constructing the treatment plant on a constrained site in close proximity to the particular institution. However, the MWRA also found that there was more net benefit to building the treatment plant on Deer Island and removing the House of Correction than building on Long Island and removing the Long Island Hispital since removal of the House of Correction would favorably affect property values and the safety of the currounding community and would promote equitable distribution of regional facilities. Further details as to the findings of the MWRA regarding the removal of the existing institutions and the Deer Island House of Correction in particular is contained in the Commitments to Mitigation section which follows.

Final Siting Decision

Having found two criteria effectively neutral between Long Island and Deer Island (Reliability and Effects on Neighbors), one criterion favoring the selection of Long Island (Equitable Distribution of Regional Responsibility) and five criteria favoring selection of Deer Island (Cost, Implementability, Harbor Enhancement, Effects on Natural and Cultural Resources and Mitigation), and having given each criterion equal weight, the MWRA determined that the most appropriate site for the harbor island wastewater treatment facility is Deer Island.

COMMITMENTS TO MITIGATION

Recongizing the need to adopt all feasible measures to mitigate the adverse environmental impacts, the MWRA, as part of the FEIR, set forth a series of mitigation commitments designed to alleviate the impacts associated with the construction and operation of the Harbor Islands plant. During the process of making its final siting decision the MWRA reviewed the public comments on the proposed mitigation commitments and the comments received from the Secretary of Environmental Affairs and adopted a final series of mitigation commitments. This section sets out those commitments.

--Commitments on Flow and Growth
--Commitments on Plant Maintenance
--Commitments on Odor Control

--Commitments on Noise
--Commitments on Barging
--Commitments on the Use of Liquid Chlorine
--Commitments on the Relocation of the Deer Island House of Correction

Commitments on Flow and Growth

Recognizing the need for responsible management and being sensitive to the possible need for expansion of the proposed Harbor Islands treatment plant, the MWRA has made the following commitments with respect to flow and growth:

- o The MWRA will undertake all necessary and prudent planning and management initiatives to avoid overloading the Harbor Islands treatment plant.

- o The MWRA will not expand the treatment plant capacity unless or until it has implemented flow management techniques and has developed and implemented a program to avoid excess pollutant loading. These techniques and programs include:

    - Conducting infiltration/inflow reduction programs

    - Instituting water conservation programs that can reduce wastewater flows

    - Pricing of water and sewer services to promote the conservation of water, thus reducing wastewater flows

    - Controlling pollutant loads through pricing strategies and pretreatment programs

    - Controlling both flow and loads through regulatory controls, such as flow reduction programs to compensate for new connections

    - The MWRA will develop monitoring and triggering programs so that it will be able to test the effectiveness of the flow management techniques and to provide the MWRA with the ability to determine when planning for the MWRA's next increment of treatment capacity should be undertaken

- o If the MWRA determines, through its monitoring and triggering programs, that the flows and loading are increasing at rates higher than projected in the FEIR, it will take all necessary steps to plan, design, and construct ancillary facilities including (but not limited to):

    - Flow control structures, such as on-line and off-line storage to minimize peak flows at the plant

    - Septage treatment facilities to reduce pollutant loadings on the Harbor Islands plant

- If the ancillary facilities are insufficient to accommodate increased flow and loading and to prevent exceeding the design capacity of the Harbor Islands treatment plant, the MWRA will take all necessary steps to plan, design, and construct satellite treatment plants unless it determines it would be economically or environmentally infeasible to do so.

- Notwithstanding the foregoing, the MWRA does not intend the adoption of the above commitments to require the postponement or cancellation of any capital program contained in the Authority's Fiscal Year 1986-88 capital budget that services to eliminate an existing problem of sewage backups.

The purpose of these commitments is to confirm the MWRA's desire to establish a sound and rational program for assessing future capacity needs, to respond to public concerns on overloading and future system expansion, and to provide a framework within which additional capacity will be planned.

Commitments to Operation and Maintenance

MWRA has already made clear its commitment to improved operations and maintenance by approving both a substantially increased operating budget and by authorizing significant increases in operations and maintenance staff for existing facilities. MWRA's commitment to maintenance is underscored by their adoption of the following assurances:

- Review of Recurrent Budgets. Annual operating budgets will be carefully scrutinized to be certain that these budgets reflect not only a sound maintenance program for existing facilities but that the budgets reflect any new facilities expected to be in service during the budget year. The MWRA will link budget expenditures with performance indicators that reflect the efficiency and effectiveness of the maintenance programs.

- Renewal/Replacement Expenditures. More than $100 million in construction projects have been initiated at the Nut Island and Deer Island treatment plants to replace much of the antiquated equipment at these plants. These upgraded programs are expected to be completed in 1989 and will contribute significantly to the reliability of the existing plant equipment. Capital budgets in future years will continue to reflect the important role that R/R plays in the maintenance of treatment facilities. The MWRA's maintenance procedures will be modified at an early date to incorporate record keeping procedures that will provide a rational basis for R/R investment in future years.

- Review of Maintenance Procedures. Prior to the completion of the on-going upgrade program, the MWRA will initiate a review of its existing maintenance procedures. Strengthened maintenance procedures will be designed including an aggressive housekeeping and preventive maintenance program. These procedures will be amended as new treatment facilities are constructed.

- o Initiate Early Planning. To ensure that operations and maintenance considerations are included as an integral part of the planning for all new facilities, MWRA will require that the plant's facilities plan include a preliminary plan of operations. The preliminary plan of operations will identify the additional or unique O & M requirements of the recommended facilities, including staffing and special training needs, manuals, special tools and workshops, and estimated budget considerations. This preliminary plan of operations will provide MWRA with two to four years' lead time prior to completion of facilities to incorporate the maintenance requirements of new facilities into on-going maintenance programs.

- o Adoption of Performance Indicators. MWRA will adopt performance indicators into the agency's proposed management information systems that will permit the Authority to review on a regular basis the level-of-effort and the performance of the maintenance activities. Indicators such as plant performance, equipment availability, maintenance labor/expenditures, custodial inspection reports, spare parts inventory, and equipment age will be monitored to regularly examine the efficiency of the maintenance efforts. Additionally, the Authority will involve the community in reviewing maintenance programs to provide focus on issues of local importance.

Commitments on Odor Control

The MWRA commits to the construction of the treatment pant that will control odors so as to eliminate detectable odors off-site and to control odors as necessary to protect the public health. Furthermore, the MWRA commits to the control of odors so as to minimize, to the maximum extent feasible, objectionable odors on-site.

The type of odor control needed will be selected during the facility planning effort. Sampling of the odor potential characteristics of the influent wastewater will be conducted as part of the facilities planning to provide the necessary data to develop a program of source control and to size and select the odor control equipment.

The most reliable means of measuring odor performances is the human nose. In order to measure the plant odor performance, an odor panel will be created composed of individuals from the community as well as individuals from the MWRA. The panel will routinely monitor for odors to ensure that no objectionable odors are occurring off-site. The panel will also respond to odor complaints received by the plant, by assisting in the investigation of the odor and recommending odor control techniques.

Commitments on Noise Control

The MWRA is committed to complying with all the legal standards of both City of Boston noise control ordinance and the Department of Environmental Quality Engineering.

Because of the scale of the proposed plant, however, the MWRA is setting as a goal noise abatement that goes beyond simply adhering to the City of Boston code. The MWRA has to define, by the FEIR, what noise levels may be achievable and will examine means of noise abatement throughout the planning, design and operation of the facility.

The MWRA further commits to the development of a program for avoiding adverse noise impacts, the components of which shall be resolved during facilities planning but which shall include the following:

- The establishment of an Acoustical Review Board. The Acoustical Review Board will include representatives from the community as well as engineers and MWRA staff.

- The use of available and feasible noise control techniques, which may include items such as the evaluation of the acoustical characteristics of operational equipment and flexible scheduling of construction activities to minimize noise.

- The establishment of necessary training and hiring practices to assume the best possible control of noise impacts.

- The involvement of the community in the development of noise control programs and the participation of community representatives in those programs.

Commitment on Barging and Busing

The determination that barging and busing are necessary is a direct consequence of the volume of traffic associated with the construction of the proposed facility and the limited capacity of roadways leading to the plant site. The Traffic section of the FEIR describes the capacity of the roadways. The commitment to barging, therefore, also requires a commitment to maximum traffic levels associated with the construction of the plant. Those traffic levels are defined for both the pier construction period and for the period thereafter.

Prior to construction of the piers, it is not feasible to barge materials to the site. Therefore, the MWRA has given a high priority to the identification of barge sites, design of pier facilities and construction of those piers. The Authority is engaged in the selection of a consultant for the necessary barge and pier facilities. The MWRA commits to limiting the trucking of materials for construction of the piers to a maximum of 20 trucks per day.

Upon completion of the pier facilities, the barging of almost all heavy construction equipment and materials is, based on the analyses conducted to date, an achievable level of barging. The level of commitment is conditioned, however, to allow for contingencies that may result from scheduling or operational problems. The extent of such contingency trucking, after the completion of the piers, will be limited to a service fleet of eight trucks. Also, in order to minimize impacts associated with commuting of construction workers to the plant site, the Authority has committed to the busing of all workers, using a maximum of 28 buses per day.

In addition, the Authority will undertake an evaluation of the practicality of providing ferries to transport construction workers to the job site.

Commitments on the Trucking of Liquid Chlorine

The MWRA has committed to cease the trucking of liquid chlorine through the streets of Winthrop as soon as possible when water access facilities become operable and the transport of alternate disinfectant or barging of liquid chlorine becomes feasible.

Commitment on Relocation of the Deer Island House of Correction

The MWRA has determined that the Deer Island House of Correction must be relocated from Deer Island by those parties with jurisdiction over its operation and that such relocation must be deemed a mandatory mitigation measure.

The MWRA's conclusion with respect to this mitigation measure is based on its findings throughout the tentative and final site decision process relative to the environmental impacts resulting from the construction of the harbor island treatment plant on either island with the existing institutions present, and the benefit to be gained by the removal of the existing institution from the island selected as the site for the treatment plant. Many of those findings, as they relate to Deer Island were addressed by the Secretary in his Certificate as well as by numerous commentors to the FEIR, all of whom found the relocation of the prison to be a required mitigation measure. The MWRA's findings on benefits which would result from relocation of the prison are summarized as follows.

The MWRA found that the reliability of the treatment plant would be greatly enhanced by providing sufficient space for optional design. The converse was also found, that building on Deer Island with the treatment plant present would require a cramped design with reduced space between piping and flow controllers resulting in decreased uniformity of flow and reduced control over the treatment process. This, in turn, would increase the possibility of operational malfunctions or decrease the ability to monitor or redress such episodes, resulting in adverse impacts on neighbors of the treatment plant.

The MWRA also found that building the treatment plant in such close proximity to the prison would cause severe visual and noise impacts on the persons living and working in that institution. The noise impacts on the prison would be above the legal standard and would require extraordinary mitigation measures to be undertaken to ameliorate the effect. Mitigation measures, such as buffers or berms, would place additional area demands on an already constrained site. Other measures, such as timing and placement of construction and equipment could adversely impact the length of construction time. Removal of the prison would eliminate such impacts and the need for such mitigation measures.

Relocation of the prison would also reduce costs. The cost of constructing the treatment plant on a constrained site with the prison present, of operating and maintaining the plant under

those conditions, and of providing the necessary mitigation measures to alleviate the proximity of the treatment plant to the prison would be significantly greater than building without the prison.

Finally, additional benefits to recreators and to non-prison receptors would accrue from the removal of the prison. Those benefits would include alleviating the visual impact of the treatment plant on Winthrop receptors by providing space for screening and modifying landforms, providing space for recreational and open land use, reducing traffic on Winthrop's streets by the approximately 114 autos a day currently used at the prison, substantially alleviating the combined impact of regional facilities on the Town of Winthrop and by enhancing the safety of the community.

For all these reasons and the reasons cited by the Secretary, some of which are echoed by other commentors, the MWRA considers the removal of the Deer Island House of Correction to be essential to the expeditious construction of new treatment facilities.

Further Measures to be Examined

The commitments to mitigation listed above comport with all mitigation measures which would be required under the MEPA statute. In fact, in many instances, as noted by the Secretary in his certificate on the FEIR, the MWRA has addressed many issues to a far greater degree than was required and has made commitments in these areas accordingly.

Nevertheless, the Secretary, in his final Certificate, has made recommendations that certain measures be undertaken either sooner than might be required or with respect to current facilities as opposed to the new treatment plant which is the subject of the FEIR.

The MWRA considers these suggestions positive and worthy of serious review. It has directed staff to evaluate the Secretary's suggestions and to recommend within thirty to ninety days where, when and how they may be responded to and the nature of the recommended response. The suggestions by the Secretary include:

1. The "Sewer Bank" concept be further explored and feasible programs developed to eliminate excess flow and accommodate new connections.

2. Accommodate future growth within the service area through satellite plants.

3. Continued and strengthened programs to monitor flows to provide sound data to gauge the effects of flow management.

4. Implement odor panel and formal odor complaint response at existing facility.

5. Consider real time monitoring of odors, perhaps using hydrogen sulfide as an indicator.

6. Consider development and implementation of a monitoring program for VOCs and other air toxics in the wastewater stream and in the ambient air.

7. Recommend implementation of an acoustic Review Board to monitor and respond to noise complaints at existing facility; and supplement such a noise program now and at the new treatment plant with periodic noise monitoring.

Summary of Impacts and Findings of Limitation of Impacts

The MWRA finds that the environmental impacts resulting from the construction of the Boston Harbor wastewater treatment facility are those impacts as described in the Draft Environmental Impact Report, elaborated on and refined in the Final Environmental Impact Report and commented upon in these G.L.C. 30, Section 61 Findings.

The MWRA further finds that its selection of Deer Island as the site for the wastewater treatment facility, and its commitment to the mitigation measure set out in the Commitments to Mitigation section of these G.L.C. 30, Section 61 Findings constitute all feasible measures to avoid or minimize the environmental impacts described.

Record of Decision

The text of EPA Region I's Record of Decision on the Final Environmental Impact Statement Siting of Wastewater Treatment Facilities for Boston Harbor is as follows:

The U.S. Enviromental Protection Agency (EPA) has prepared this document as its Record of Decision (ROD) for the Final Environmental Impact Statement (FEIS) on the siting of the Massachusetts Water Resources Authority (MWRA) wastewater treatment faciities which will abate the pollution of Boston Harbor.

The MWRA has the responsibility of selecting the site for the wastewater treatment facilities. EPA's primary responsibilities are to conduct an evaluation of environmental acceptability under the National Environmental Policy Act (NEPA), provide federal financial assistance if available, and ensure rapid compliance with the Clean Water Act.

EPA issued a Supplemental Draft EIS (SDEIS) in December, 1984 and a FEIS on December 2, 1985 on the siting of wastewater treatment facilities for Boston Harbor. These documents evaluated the environmental impacts of various site options for facilities to treat Greater Boston's wastewater in compliance with water pollution control laws. The SDEIS also served as a Draft Environmental Impact Report (DEIR) under the provisions of the Massachusetts Environmental Policy Act (MEPA) for the Metropolitan District Commission (MDC). Since publication of this joint document, the sewer functions of the MDC have been reorganized into the MWRA. The Board of Directors of the MWRA chose to follow an independent but parallel decision process and to publish a separate but concurrent Final Environmental Impact Report (FEIR) under state law.

Following the concurrent publication of EPA's FEIS and MWRA's FEIR, EPA and MWRA conducted joint public hearings before reaching their respective final decisions. Public hearings were held on January 13, 14 and 15, 1986 in Quincy, Boston and Winthrop. Oral and written comments were submitted during the comment period. The public comment period ended on January 21, 1986 for the FEIS and January 24, 1986 for the FEIR.

In February, 1986, the MWRA determined that "the most appropriate site for the harbor island wastewater treatment facility is Deer Island." This ROD identifies EPA's final decision on the siting issue. This ROD is being circulated to inform the public of this decision and to respond to the comments on the FEIS.

I. EPA's FINAL DECISION ON THE SITING OF SECONDARY WASTEWATER TREATMENT FACILITIES FOR BOSTON HARBOR

With the understanding that EPA will require the MWRA to carry out the program of specified mitigation measures identified on pages 52-55 of the FEIS, Volume I, EPA's decision is that its preferred alternative is the All Secondary Deer Island alternative, which is set forth in the EIS and described below. All Secondary Long (without the hospital) is also environmentally acceptable and is preferred over Split Secondary Deer-Long (without the hospital). The only alternative which EPA finds unacceptable is Split Secondary Deer-Nut. The decision process and the program of required mitigation measures is described in more detail in Section III.

EPA's preferred alternative for secondary treatment, All Secondary Deer, would expand the existing primary wastewater treatment facility at Deer Island to a secondary treatment plant. It would reduce the existing primary treatment facilities at Nut Island to a small headworks. It would include construction of a major new pipeline or tunnel from Nut Island to Deer Island and of an effluent outfall to the east of Deer Island Light. The existing wastewater treatment facility on Deer Island would be increased from 26 acres to about 115-140 acres while on Nut Island the existing wastewater facility would be reduced from 12 acres to about 2 acres.

This alternative would commit almost all the land on Deer Island south of the existing prison to wastewater treatment and level the most prominent topographic features of the island. This alternative would also require the construction of a bulk materials loading pier(s) and roll-on roll-off facilities at the site, and associated terminal(s) on-shore.

The estimated construction cost of this alternative would be about $1.135 billion and its annual cost of operation, maintenance and replacement would be about $50 million. Costs, acreage requirements, exact plant layout and mitigation measures will be developed in greater detail during further facilities planning on the project.

The Benefits of Moving the Prison

The MWRA favors a variation of the All Secondary Deer Island alternative which assumes that the prison would be removed as a mitigation action, and that its site would be made available for the treatment plant. This variation would also use most of the Island but prison removal would reduce the impacts of the treatment plant in several ways:

1. It would remove the receptor population (the prison workers and inmates most affected by the plant's impacts, including noise and odor).

2. It would eliminate prison-related traffic, thus offsetting construction-related and operations traffic for the treatment plant.

3. It would improve the appearance of Deer Island by removing the prison buildings.

4. It would permit opportunities for sculpting the landscape to a more natural appearance and for screening the facility from both the harbor and Point Shirley and Cottage Hill in Winthrop.

5. It would increase the opportunity for buffering noise at Point Shirley by earthen barriers on prison property.

6. It would permit the retention of a portion of the Island's shoreline for buffering and recreation.

7. It would remove prison-related anxieties from Winthrop.

8. It would make more land available for the wastewater treatment facility, possibly making construction and maintenance easier.

This variation does not eliminate the need for any of the mitigating actions proposed for the All Secondary Deer Island alternative with the prison to remain, except for those intended to reduce impacts at the prison itself, e.g., a noise barrier.

However, the process required to release the Deer Island prison site for treatment plant use could be so lengthy as to delay or frustrate the construction of this variation of the All Secondary Deer Island alternative. EPA has long advocated removal of the prison if Deer Island is to be the treatment plant site, but EPA will not require removal of the prison as a grant condition. Implementation of secondary treatment is required by the Clean Water Act and cannot be made dependent upon removal of the prison if the site is acceptable. This ROD concludes

that in EPA's judgement the All Secondary Deer Island Alternative is its preferred alternative and can be implemented without unacceptable environmental impacts even if the prison remains.*

II. SELECTION OF ALTERNATIVES FOR EVALUATION

Federal regulations require EPA, during environmental review, rigorously to explore all reasonable alternatives for the siting of wastewater treatment facilities for Boston Harbor. Most of the alternatives initially investigated were derived from the EPA's 1978 Draft Environmental Impact Statement (DEIS), which examined only secondary treatment options, and the MDC's 1982 Nut Island Site Options Study. The Site Options Study identified eleven alternatives (eight secondary and three primary treatment alternatives), including some previously examined in the DEIS. In September, 1983, EPA and the Commonwealth conducted two public scoping meetings to receive comments on these initial alternatives from the public and from federal, state and local officials. Upon completion of the joint scoping meetings, EPA selected eleven additional alternatives for analysis, for a total of twenty-two alternatives to be studied. These included twenty alternatives for treatment at Deer, Long, Nut, or man-made islands and two alternatives including sub-regional "satellite" plants. A complete discussion of the twenty-two initial primary and secondary alternatives appears in the SDEIS at Vol II, Section 12.12. Table I is a complete list of the twenty-two initial options.

[See Table I on page 3-38 in this Section.]

III. DECISION PROCESS

To examine such a large number of alternatives, a screening process was developed jointly with the Commonwealth. Its objective was to narrow the number of alternatives being investigated and to eliminate those that clearly offered few benefits or had significant adverse impacts. This initial screening of alternatives is summarized here; it is described in detail the SDEIS. Each alternative's economic, social and environmental impacts were studied. In addition, their technical, legal, institutional and political problems were also analyzed. Specific criteria were developed for comparison and screening of the options.

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* The Clean Water Act requires that wastewater treatment plants be constructed which will provide "secondary" treatment unless EPA, under strict statutory guidance, grants a waiver, under Section 301(h) of the Clean Water Act, permitting a lesser "primary" degree of treatment with a deep ocean dicharge. EPA has twice denied the MDC/MWRA request for such a waiver but final rights of appeal have not expired. EPA believes it is highly unlikely any such appeal, even if pursued, would prevail on the merits, or that the discharge of primary effluent into Massachusetts Bay would ultimately be permitted over the opposition of the Governor and other officials. However, in the interest of completing the NEPA review, EPA has decided in this ROD to resolve the siting of a primary treatment plant as well. The decision is the All Primary Deer Island alternative.

TABLE I

LIST OF TWENTY-TWO INITIAL OPTIONS STUDIED IN THE SDEIS

Secondary Treatment Alternatives

1a.1 Secondary Treatment at Deer Island, Headworks at Nut Island with separate North and South System Secondary Treatment Processes.

1a.2 Secondary Treatment at Deer Island, Headworks at Nut Island with combined North and South System Secondary Treatment Processes.

1b.1 Secondary Treatment at Deer Island, Primary Treatment at Nut Island for South system, separate North and South System Secondary Treatment Processes.

1b.2 Secondary Treatment at Deer Island, Primary Treatment at Nut Island for South System, combined North and South System Secondary Treatment Processes.

1c Secondary Treatment at Deer Island for North System, Secondary Treatment at Nut Island for South System.

2a.1 Secondary Treatment at Deer Island for North System, Secondary Treatment at Long Island for South System, Headworks at Nut Island.

2a.2 Secondary Treatment at Deer Island for North System, Secondary Treatment at Long Island for South System, Primary Treatment at Nut Island.

2b.1 Headworks at Deer Island for North System, Headworks at Nut Island for South System, Consolidated Secondary Treatment at Long Island.

2b.2 Primary Treatment at Deer Island for North System, Primary at Nut Island, Consolidated Secondary Treatment at Long Island.

2b.3 Headworks at Nut Island, Primary Treatment at Deer Island for North System, Consolidated Secondary Treatment at Long Island.

3a Headworks at Deer and Nut Islands, Consolidated Secondary Treatment at Lovell's Island.

3b Headworks at Deer and Nut Islands, Consolidated Secondary Treatment at a new man-made island.

Primary Treatment Alternatives

4a.1 Primary Treatment of All System at Deer Island, Headworks at Nut Island. Local Outfalls.

4a.2 Primary Treatment of All System at Deer Island, Headworks at Nut Island, Deep Ocean Outfalls.

4b.1 Primary Treatment at Deer Island for North System, Primary Treatment at Nut Island for South System, Local Outfalls.

4b.2 Primary Treatment at Deer Island for North System, Primary Treatment at Nut Island for South System, Deep Ocean Outfalls.

5a.1 Primary Treatment at Deer Island for North System, Primary Treatment at Long Island for South System, Headworks at Nut Island. Local Outfalls.

5a.2 Primary Treatment at Deer Island for North System, Primary Treatment at Long Island for South System, Headworks at Nut Island. Deep-Ocean Outfalls.

5b.1 Headworks at Deer and Nut Islands, Consolidated Primary Treatment at Long Island. Local Outfalls.

5b.2 Headworks at Deer and Nut Islands, Consolidated Primary Treatment at Long Island. Deep-Ocean Outfalls.

Satellite options 1&2 - Satellite facilities for South System with discharge to Charles and Neponset Rivers. Satellite facilities for South System with wetlands discharge.

In screening the initial alternatives, it became clear that no alternative was without some potentially adverse impacts. Furthermore, no alternative satisfied all of the criteria used in the analysis. Considering the size and complexity of the project, virtually all alternatives were considered to have at least one or more drawbacks that limited their acceptability to some affected group(s).

The initial screening process concluded that of the twenty-two alternatives studied, four secondary treatment options and four primary options conformed to these criteria and warranted further investigation and more detailed study. These alternatives reflected different approaches to the siting requirements of the MDC system. The impacts of these options also varied in their respective advantages and disadvantages. The eight alternatives are identified below according to their abbreviated names used in the EIS. (Parenthetical references in Table I refer to the nomenclature used in the initial screening process.)

a. Secondary Treatment (Harbor Entrance Outfall) Alternatives:

1. All Secondary Deer Island (1a.2)

2. Split Secondary Deer Island and Nut Island (1b.2)

3. All Secondary Long Island (2b.1)

4. Split Secondary Deer Island and Long Island (2b.3)

b. Primary Treatment (Nine Mile Outfall) Alternatives:

1. All Primary Deer Island (4a.2)

2. Split Primary Deer Island and Nut Island (4b.2)

3. All Primary Long Island (5b.2)*

4. Split Primary Deer Island and Long Island (5a.2)

A detailed assessment of the impacts of these alternatives was provided in the SDEIS. Figure I shows the eight alternatives with their respective facilities and harbor locations.

During the further preparation of the SDEIS, relevant Massachusetts agencies and the EPA agreed that it was necessary to refine the decision process because of the complexity of the siting decision and the great number and variety of factors which must be taken into account by decision-makers. The first step was to re-analyze the various arguments and considerations that had been brought to bear on this controversial siting decision by all concerned parties in order to determine their disparate objectives. These objectives were used to develop a more precise set of decision criteria against which the remaining alternatives were to be evaluated. It was the goal of the SDEIS to make the list short, yet inclusive of all concerns that had been raised. Six decision criteria were identified. Each alternative was to be evaluated to determine the extent to which it:

1. is consistent with and, if possible, promotes the fulfillment of the promise of Boston Harbor. (Harbor Vision)

2. can be implemented in a timely and predictable manner. (Implementability)

3. minimizes the adverse impacts of the facility on neighbors, taking into consideration existing conditions, facility siting impacts and mitigation measures. (Effects on Neighbors)

4. minimizes the impacts of the facilities on natural and cultural resources. (Impact on Cultural and Natural Resources)

5. can be built and operated at a reasonable cost. (Cost)

6. maximizes the reliability of the entire treatment system. (Reliability)

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* Though the SDEIS/EIR suggested that one alternative, All Primary Long, should also be screened out and not receive further active consideration, the SDEIS/EIR and the FEIS contained a full evaluation of All Primary Long. EPA considers that all eight alternatives received an equal level of analysis.

Finally, EPA and the Commonwealth developed a comprehensive program of mandatory measures applicable to all alternatives: barging of materials, busing of workers, and noise and odor control.

Thus, in the SDEIS/EIR, EPA and the Commonwealth had narrowed the options remaining for secondary or primary treatment from twenty-two to eight alternatives, but had not arrived at a statement of two preferred alternatives, one for secondary treatment and one for primary treatment. The most important factor leading to this outcome was a desire on the part of both EPA and the Commonwealth to encourage public scrutiny and obtain formal public comment on the results of initial screening process, the large amount of new data, the new decision criteria and the proposed mandatory mitigation before proceeding to suggest two preferred alternatives.

After the close of the SDEIS/EIR public comment period, in light of the high degree of public acceptance, EPA decided to retain criteria as a way to impose order on a mass of detail in this especially complex review, and to focus on those impacts which are relevant to the choice of a site. EPA also reviewed all the public comments submitted to identify both those criteria-relevant issues which needed futher analysis prior to selection of a preferred alternative and those other issues which related to the overall project or were otherwise not criteria-relevant, but which were appropriate for inclusion in the FEIS or the FEIR. EPA performed additional analyses on potentially site-relevent topics.

EPA and the MWRA agreed that it was appropriate for each to pursue an independent decision-making process under their respective statuatory mandates but to do so in parallel and with a high degree of coordination. Accordingly, to ensure that both agencies shared a common data base, as either agency identified data needs or developed information, it was shared with the other by exchange of technical memoranda and through technical presentations at meetings with EPA's Technical Advisory Group or with the MWRA's Board of Directors or staff.

EPA systematically reviewed its entire data base using the decision criteria and evaluated each piece of data in terms of one or more of the appropriate decision criteria. EPA felt that each decision criterion was legitimate and was confident that sufficient objective data existed to permit a reasoned judgement as to the acceptability of the alternative sites.

Mandatory Mitigation Measures

Upon the completion of the review of each decision criterion, the assumed level of mandatory mitigation as set forth in the SDEIS/EIR was either confirmed or, if appropriate, modified as the result of further technical information. EPA found that the most critical need for mitigation was to reduce impact on neighbors. EPA applied a set of specific mandatory mitigation measures to all alternative sites except as noted below. The mandatory mitigation measures can be summarized as follows:

- o Barging of bulk materials to and from the site to reduce the amount of trucking through affected communities during construction;

- o Use of a roll-on/roll-off barge loading facility at the site and at an onshore transfer station to accommodate heavy trucking;

- o Busing and ferrying of construction workers to reduce commuter traffic in affected communities during the construction period;

- o Use of "maximum feasible degree" of odor control and investigation of state-of-the-art odor control technology;

- o A ban on the use of liquid chlorine at Deer Island unless there is "clear and convincing" need for it and proof that it can be handled without unnecessary risk to neighbors, including the prison workers and inmates;

- o Implementation of noise control measures during construction, including the excavation of the Deer Island drumlin from the south side so that the remaining mass of the drumlin acts as a shield, and construction of a sound barrier at the Deer Island prison.

- o Prohibition against trucking liquid chlorine to Deer Island as soon as piers and staging areas are available to commence over-water transport;

- o Exploration of alternatives to the use of liquid chlorine at the treatment plant and at the associated headworks;

- o Sampling of volatile organic compounds downwind from the existing primary plants at Deer and Nut Islands, exploration of technologies to control these compounds and installation of appropriate controls if necessry;

- o Exploration of alternative treatment processes that might be less space demanding, less costly, or more reliable than secondary treatment based on the activated sludge process;

- o Exploration of the feasibility of developing recreational uses of the site along with the treatment plant;

- o Control of dust, erosion and sedimentation.

For a detailed statement of the mandatory mitigation measures, see pages 52-55 of the FEIS Volume I. Each of these mitigating efforts will be the subject of detailed study by the MWRA as further facilities planning explores these ways of achieving acceptable levels of impact. EPA, after appropriate environmental review, is prepared to modify these mitigation measures if equally effective protection can be achieved by other methods.

In the judgement of EPA, these stringent mandatory mitigation measures include all practicable means which are necessary and appropriate to avoid or minimize environmental harm from the alternative selected. EPA acknowledges that in some cases its mitigation package differs from the mitigation commitments described in the MWRA's FEIR and its findings under Section 61 of MEPA. EPA is confident, however, that its mandatory mitigation measures would result in an extraordinary degree of mitigation which would effectively minimize environmental harm.

Final Analysis*

During the final analysis, it became clear that three of the decision criteria, through theoretically important, no longer played site-distinguishing roles.

1. On "Cost," a more detailed analysis revealed that the costs of the four alternatives were so close that EPA decided to regard this decision criterion as having neutral effect.

2. On "Reliability," each of the sites permitted treatment plants of equal reliability.

3. On "Impact on Cultural and Natural Resources," though this decision criterion included federally protected resources (wetlands, barrier beaches, recognized historical and archeological sites, etc.), the impact of plants on either Deer or Long Island would be essentially equal and acceptable. On Nut Island, however, the Split Secondary Deer-Nut Alternative would involve the serious impacts of filling of tidal areas (unless homes were taken) and this was taken into account in the final decision.

Thus, "Effects on Neighbors," "Harbor Vision," and "Implementability" remained as the principal decision criteria for EPA. EPA felt each of these three criteria represented protection of important public values of substantial weight and each will be discussed below:

1. With respect to the "Effects on Neighbors" decision criterion, should the "no prison" variation of the All Secondary Deer Island alternative be implemented, EPA concluded that a treatment plant at either Deer Island or Long Island would have acceptable and essentially equal impacts on its neighbors, with the mandatory mitigation measures in place. However, if the prison were to remain on Deer Island, EPA concluded

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* In the following discussion it is important to note that, in the SDEIS/EIR, EPA and the Commonwealth concluded that under both Long Island alternatives, the Long Island hospital must be relocated off-island in order to avoid unacceptable impacts to "Effects on Neighbors," "Harbor Vision," and "Cultural and Natural Resources." EPA believes this conclusion remains valid.

that a plant site on Deer Island would have a greater effect on its neighbors than a site on Long Island, but these impacts as mitigated were acceptable. EPA felt that removal of the prison was desirable but not mandatory. EPA also concluded that the mandatory mitigation reduced the impacts so substantially that the plant could be constructed without unacceptable impact despite the presence of the airport and the prison.

The Split Secondary Deer-Long alternative would involve major construction activity of approximately the same perceived effect on the neighbors of each island as if the entire plant were being constructed there. Though those effects were found to be acceptable, it was felt to be unwise to impact two sets of neighbors unless there would be some benefit to another decision criterion; there was not.

Split Secondary Deer-Nut imposed severe burdens on its immediate neighbors on Hough's Neck without any corresponding benefit to Deer Island and Point Shirely. It was found to be environmentally unacceptable.

2. Considering only the "Harbor Vision" decision criterion, EPA concluded that though all four alternatives were acceptable, the All Secondary Deer alternative was preferred under "Harbor Vision". EPA believes that Deer Island's size, topography and setting give it acceptable long-term potential for rehabilitation as a park resource. However, because of Long Island's current potential as a major island park, EPA did conclude that while both All Secondary Deer and All Secondary Long satisfied the Harbor Vision decision criteria, All Secondary Deer satisfied it better.

Less acceptable were the other two alternatives. Though Split Secondary Deer-Long preserved significant potential recreation space at each island, EPA agreed with the Commonwealth that an entire island as park was preferable. Split Secondary Deer-Nut committed Nut Island to wastewater treatment without any corresponding benefit at Deer Island; though Nut Island has not been a major part of a harbor park plan, it could provide locally important open space.

3. Considering only the "Implementability" decision criterion, the following issues were of principal importance: permits and licenses, and the attitudes of the City of Boston and agencies and legislature of the Commonwealth. Even prior to the July 10, 1985, vote of the MWRA selecting All Secondary Deer Island as its tentative preferred alternative, EPA had concluded that the "Implementability" decision criterion pointed to All Secondary Deer with or without the prison because the principal remaining alternative, All Secondary Long (without the hospital), faced significant opposition. However, EPA was concerned that Deer Island prison removal was uncertain.

The July 10, 1985, and February, 1986 votes, and the MEPA Sec. 61 Findings of the MWRA, the proposing agency, which has the statutory authority to build the treatment plant and which controls much of Deer Island, confirmed EPA's conclusion that the All Secondary Deer alternative was clearly more implementable than any of the other alternatives.

The Governor's continued support of the MWRA, his renewed commitment to facilitate

relocation of the prison, and his new offer to identify a new prison site by May, 1986, further supports this result. Other officials have reiterated their support for prison removal if Deer Island is to be the site. As stated by the Secretary of Environmental Affairs in his Certificate on the FEIR, Janury 21, 1986:

> "...[T]hrough the joint struggle of all branches of government, the courts, the press, and the public, important milestones have now been passed - the creation of the Authority and public consensus on siting. A momentum has now built up, which I consider so powerful that the cleanup cannot and will not be stopped. The joint will of Mayor Flynn, Governor Dukakis, the General Court and our citizens is so strong that I am convinced the difficulties of prison relocation can be overcome..." (emphasis added)

EPA agrees with the MWRA that the reinforced support of relevant public officials for Deer Island prison removal and the continued opposition to Long Island Hospital removal makes prison removal "far more feasible" than hospital removal.

Furthermore, even if the prison were to remain, EPA notes the continued strong opposition of the city and state officials who control the future of Long Island to any use of Long Island as a treatment plant and notes their reiterated support for a Long Island park and for a continued role for the Long Island Hospital and Homeless Shelter.

Therefore, EPA confirms its previous judgement that All Secondary Deer Island (even if the prison were to remain) is more implementable than either of the other two environmentally acceptable alternatives: All Secondary Long and Split Secondary Deer-Long (both without the hospital).

In summary, with mandatory mitigation,

1. EPA found Split Deer-Nut to be environmentally unacceptable because of its severe impact on its "Neighbors" at Nut Island and on "Natural Resources," and strong barriers to "Implementability."

2. EPA found Split Deer-Long (without the hospital) to be environmentally acceptable; but EPA also found it to be undesirable because it spreads impacts on "Neighbors" and "Harbor Vision" to two islands without any benefit deemed valuable to a decision criterion. It also was unlikely to be "Implemented."

3. EPA found both All Secondary Long (without the hospital) and All Secondary Deer to have an acceptable impact on "Neighbors" and "Harbor Vision."
   a. "Neighbors." With mitigation, the impact of a Deer Island plant on its "Neighbors" is either equal to (without the prison) or worse than (with the prison) a Long Island plant.

b. "Harbor Vision." The impact of a Deer Island plant on the public benefits from and uses of Boston Harbor causes somewhat less harm than a Long Island plant.

c. "Implementability." Between these two acceptable and closely balanced alternatives, building a treatment plant on Deer Island (with or without the prison) is clearly more "Implementable" than building a Long Island Plant.

EPA's decision based on the foregoing analysis is that its preferred alternative is All Secondary Deer with mandatory mitigation. The FEIS contains more information on the decision process.

IV. IMPLEMENTATION, MONITORING, ENFORCEMENT OF MITIGATION MEASURES

Applicable regulations require EPA, in this ROD, to adopt and summarize an implementation, monitoring and enforcement program for its mitigation measures.

EPA's first implementation, monitoring and enforcement mechanism will be through the construction grants program. Section 201(g) of the Clean Water Act authorizes the Administrator to grant financial assistance to municipalities for the construction of municipal wastewater treatment plants. Section 511(c) of the Act states that the award of a construction grant may be considered a major federal action significantly affecting the quality of the human environment, subject to the requirements of NEPA. These statutes give EPA the authority to enforce the mandatory measures through the federal construction grants program. The mandatory mitigation measures for the selected site at Deer Island will be made necessary conditions of any Federal construction grants awarded to the MWRA during the Step 3 Construction Phase of this project.

EPA has determined, pursuant to Section IV B 7 of the 1984 Construction Grants Delegation Agreement and 40 CFR Section 3015(c), that an overriding federal interest exists in this project, in particular in regard to the implementation of the mandatory mitigation program specified in the FEIS. In order to ensure that all mandatory mitigation measures are implemented through the construction grants program, the agency will play a direct role in oversight of facilities planning, design and construction of the wastewater treatment plant including piers, outfalls and pipelines/tunnels. The specific role that EPA plans to play will be at least as follows:

- o review all sections of all the facilities plans to ensure compliance with the mandatory mitigation program as set forth in FEIS Volume I, p.53-55.

- o coordinate with the Massachusetts Department of Environmental Quality Engineering (DEQE), Division of Water Pollution Control in reviewing the plan of study for the facilities plans.

- o participate in any technical and citizen advisory committees as part of the public participation program for the facilities plan.

- o participate in the review of the draft products of the facilities plans, particularly the development of the mandatory mitigation measures.

- o EPA will review at least the specifics of the proposed odor control program, noise control program and possible volatile organic compound emissions control program to ensure that MWRA is achieving effective impact reductions required by this ROD. On the issue of liquid chlorine use, EPA will ensure in its review of the facilities plan that MWRA has undertaken a thorough disinfectant alternatives analysis. On the issue of busing, ferrying and barging, EPA will monitor the development of the facilities planning investigations to ensure that MWRA establishes the required programs to mitigate transportation impacts.

- o coordinate with DEQE for joint review and approval of the final facilities plans. The facilities plans will be approved only upon successful development of the mitigation program as outlined in the FEIS.

- o EPA will request the Army Corps of Engineers, during construction, to make periodic onsite reviews to ensure that the project is being managed properly, is on schedule, and is being constructed in accordance with approved construction drawings and specifications including mitigation measures and change orders.

In order to facilitate a high degree of review oversight by EPA, the agency intends to enter into an agreement with the DEQE Division of Water Pollution Control and MWRA to outline further details of EPA's oversight.

In addition to EPA oversight and participation in further facilities planning, EPA intends to assume primary responsibility for NEPA review by the preparation of any environmental assessments or supplemental EIS's determined to be necessary in connection with these activities. EPA and the Army Corps of Engineers plan to enter into a Memorandum of Understanding in order to minimize delays in any environmental reviews involving both agencies.

Second, the MWRA is under federal court order to initiate facilities plans for the shore-side piers and staging areas, on-site piers and staging areas, outfalls and tunnels or piplines. The MEPA unit of the Executive Office of Environmental Affairs has made the determination that EIR's will be prepared on these facilities plans. In addition, the facilities plans will include EID's which provide environmental evaluations of the final facilities plan components. EPA will conduct an independent environmental review, under NEPA, of these facilities plans, except for those aspects of the wastewater treatment plant covered by this EIS.

Third, in the unlikely event that federal funding for this project were to be totally unavailable due to the termination of the Construction Grants Program, this project will require other federal actions which bring it within NEPA. These include the transfer of surplus federal lands by the General Services Administration (GSA); permit actions by the Corps of Engineers for the construction of piers and the disposal of dredged material or fill; and possible permit actions by EPA for the ocean disposal of fill. Each of these actions triggers independent opportunities to implement and enforce the mitigation program. For example, GSA intends to dispose of the surplus property in accordance with the FEIS and has committed to incorporate the mandatory mitigation measures into its own Record of Decision as appropriate.

Fourth, this project is now the subject of a federal court action (United States of America v. Metropolitan District Commission, et al., Civil Action No. 85-0489 D.C. MA and a related case.) In the event of the cessation of the construction grants program, EPA will also consider seeking an order of the federal court mandating that the mitigation program laid out in the FEIS be implemented.

Fifth, it should also be noted that the MWRA has committed to the Commonwealth that it will undertake a set of mitigation measures which are, with the exception of prison removal, substantively equivalent to those required by EPA. These are contained in the Section 61 Findings of the MWRA to the Secretary of Environmental Affairs under the MEPA.

[See also Section 3.2.11 (FINAL SELECTION) of this Volume.]

FURTHER ENVIRONMENTAL REVIEW UNDER NEPA

EPA expects that further environmental review under NEPA relating to the cleanup of Boston Harbor will include appropriate study of the following phases of the process, including cumulative impacts:

1. Long-term residuals management, including the processing, transport and ultimate disposal of sludge. Scoping for this EIS has already commenced.

2. The construction of pier(s) and staging area(s) at the treatment plant site and on shore to allow for barging of bulk construction materials, equipment, and work crews during construction, and possible transport of sludge. In the event that an existing pier cannot be located on the mainland, an additional pier or piers and staging area(s) would need to be constructed there.

3. The construction of an under-harbor tunnel or pipeline to transport wastewater to the treatment plant.

4. The water quality and construction impacts of an outfall pipe or pipes through which effluent will be discharged.

5. The possible disposal of earthen or dredge materials which might need to be removed from the site of the secondary treatment plant prior to construction.

6. The possible transport, handling, storage, and use of chlorine at the secondary treatment plant, depending upon the outcome of studies by MWRA regarding the environmental acceptability of its transport, handling, storage and use.

7. Combined sewer overflow projects.

CONCLUSION

EPA has engaged in a decision process which gathers technical information, exposed it to extensive public scrutiny, developed very stringent mitigation measures, and evaluated the alternatives in terms of disclosed decision criteria. EPA believes this open process has arrived at a fair and reasonable conclusion that the upgraded treatment plant, considered singly or in combination with other conditions, will be constructed and operated with acceptable environmental results.

3.3 RELATED PROJECTS

3.3.1 PROJECTS

Although the Secondary Treatment Facilities Plan is the beginning of the key project in the Boston Harbor Cleanup Program, there is a long list of projects that are being planned, designed or are under construction to upgrade and expand MWRA's wastewater collection and treatment capabilities. These projects are grouped into the following programs:

Treatment Plant Upgrade
- Nut Island Immediate Upgrade
- Deer Island Fast Track Improvements

Interim Residuals Management
- Interim Sludge Processing and Disposal
- Interim Scum Management

Long-Term Residuals Management
Water Transportation Facilities
Combined Sewer Overflows
Harbor Research and Monitoring
Wastewater Transport Program

In addition to the above wastewater programs, several waterworks projects have either a direct or an indirect bearing on the secondary treatment facilities planning. MWRA has also initiated several projects to strengthen its ability to direct and manage its extensive capital program and its extensive day-to-day operational responsibilities. The projects designed to strengthen

MWRA's institutional capability are described in Volume VII, Institutional Considerations. The related wastewater programs are described briefly in the following paragraphs.

3.3.2 INDUSTRIAL WASTE PROGRAM

In February of 1973, MWRA's Industrial Waste Program began to acquire data on all industries within the 43 cities and towns which comprise the sewerage district. This program has become the means whereby the Authority enforces Federal, State and MWRA regulations which govern the discharge of wastewater to the sewer system. The goals of the enforcement strategy are to decrease and control pollution loads to the treatment works; increase safety for maintenance and operational personnel; reduce illegal waste discharges such as extraneous water and septage from non-member municipalities; and prosecute for willful damage or vandalism.

The Industrial Waste Program, which was approved by the EPA in July of 1982, is being implemented in four phases: Inspections, Monitoring, Permitting and Enforcement.

Inspection Activities

The inspection program includes on-site inspection of all indusries in the district. It requires a discussion period with appropriate plant personnel to ascertain the type of activity being performed at the facility, the raw materials used, products and services produced, and the particular processes and unit operations employed. A tour of the facility is also conducted to verify the information received. Industries suspected of discharging a questionable waste are required to submit the results of laboratory analyses, performed on representative samples of the process waste by an independent laboratory, for review and evaluation by the Authority. The results of analyses, along with other pertinent information (permit application, inspection reports) on the industry, are used to determine whether or not the wastes are in compliance with MWRA's Rules and Regulations. A permit application must be completed by all users discharging industrial wastes.

An intensified Industrial Inspection Program has commenced as a result of the increase in staff and resources. In Fiscal Year 1987, approximately 425 industrial inspections were conducted.

Septage Disposal Inspection Program

The Septage Disposal Inspection Program is basically divided into two activities: first is the oversight of the septage control activities of the member municipalities with septage receiving locations; and second is surveillance of each septage receiving location to determine compliance with MWRA Rules and Regulations and to identify any illegal septage dumping.

Each member municipality which operates or has designated a septage receiving station is responsible for the control and monitoring of all activities at the septage receiving location. The Water Quality Department evaluates control procedures at each septage receiving location for the purpose of determining the municipality's ability to control the dumping of septage

from non-member communities, to prevent the discharge of industrial or toxic wastes, and to verify the origin of all septage received at each septage receiving location.

In some instances the possibility of illegal or uncontrolled dumping at certain septage receiving locations is suspected. In response to these instances, surveillance of the septage receiving site is conducted in order to document septage disposal, and possibly identify illegal dumping activities requiring enforcement of dumping restrictions.

Identification of I/I and Surcharging During Routine Investigations

In addition to identifying sources of toxic discharges to the sanitary sewer system, investigations at industrial facilities often identify the illegal discharge of "clean" water, also known as inflow. During these industrial investigations the most common form of inflow uncovered is non-contact, uncontaminated cooling water and non-contact, uncontaminated industrial process water.

In addition to identifying these and other sources of inflow, inspection personnel often identify excessive use of water and make recommendations to limit water use. These recommendations serve to reduce the flow in the already overloaded sewer system, which helps to minimize surcharging.

Monitoring Activities

The Monitoring Section of the Water Quality Department continually participates in a variety of activities, the most significant being monitoring for the Industrial Waste Pretreatment Program. More specialized areas of monitoring include sampling at the Treatment Plants, combined sewer overflow (CSO) treatment facilities, and CSO outfalls fulfilling NPDES permit monitoring requirements, soil sampling, beach sampling, and verification of discharges and connections. Monitoring activities during Fiscal Year 1987 numbered 565, compared to 200 in Fiscal Year 1986.

Collection of industrial waste samples from industries discharging into the Authority's Sewer System yields a profile of industrial wastes currently entering the system and provides the basis for enforcement to eliminate unacceptable concentrations of toxic and potentially harmful substances. The samples collected are forwarded to a laboratory for analysis, where strict Quality Assurance/Quality Control procedures are employed. Analytical results from this monitoring, in conjunction with information derived from inspecting and permitting activities, assist in determining the acceptability of the discharge and whether enforcement action is warranted.

The Monitoring Team has been involved in site assessment and the implementation of the monitoring program to fulfill the NPDES Permit requirements. The permit requires monitoring at Deer and Nut Island Treatment Plants, at the three CSO treatment facilities (Cottage Farm Chlorination and Detention Station, Charles River Estuary CSO Treatment Facility, Somerville

Marginal CSO Pretreatment Facility), and at CSO outfalls. At the treatment plants, samples are taken monthly for parameters not monitored daily by the plants, such as organics, metals and cyanide.

Beach sampling has been frequently requested in response to reports of odor problems and unidentified growths or discharges into the Harbor.

Other monitoring activities include sampling soil or sludge to determine the degree of contamination to assist in proper disposal decisions, verification of discharges and connections via dye tests and researching sewer line maps, groundwater sampling, and sampling at construction or cleanup sites before discharge to the sanitary sewer system.

Municipal Permits/Sewer Use Discharge Permits

Sewer Use Discharge Permits are issued to sewer users discharging industrial wastes located in the Authority Sewer District regardless of size, type or volume of discharge. The Sewerage Division has classified all industrial users into four categories according to the nature of their wastes. The categories are as follows:

1. Industries requiring pretreatment.
2. Industries having some toxic discharges but at concentrations which do not require pretreatment.
3. Industries which have non-toxic discharge in addition to sanitary flow.
4. Dry industries or industries with sanitary flow only.

Sewer Use Discharge Permits, issued to industries in the first three categories noted above, are revised as new information is received. At present, much of the activity involving permits is due to revisions and renewals, which are done on a daily basis.

Compliance and Enforcement

The Authority has been extremely successful in working with its Sewer Users in a cooperative spirit to eliminate existing or potential discharge problems, since the inception of the Industrial Waste Program. Over the years, thousands of industries and other sewer users have been inspected, monitored and issued permits. Through the inspection, monitoring and permit phases of the Water Quality Department's Industrial Waste Program, many of these industries were found to be in violation of acceptable discharge practices. Any continued violations of permit conditions or Sewer Use Rules and Regulations will result in enforcement actions to assure compliance with acceptable discharge practices. New Sewer Use Rules and Regulations promulgated May 1, 1987 have broadened the scope of MWRA enforcement powers, including rights to:

1. Issue an order to cease and desist any such discharge violations;

2. Direct a User to submit a detailed schedule, subject to such modifications as the Authority deems necessary, setting forth actions to be taken to correct or prevent a violation;

3. Issue an implementation schedule ordering specific actions and a time schedule;

4. Revoke, modify or deny a permit issued to the User by the Authority;

5. Impose administrative penalties up to $10,000 per day of continued violation, and seek payment for damages to its system pursuant to 360 CMR 10.105 and 360 CMR 2.00;

6. Bring a civil or criminal action as provided by law; or

7. Take any other action available to it under federal, state or local law or regulation.

In cases where significant resistance is given to the Authority's discharge regulations, enforcement actions have been initiated. Enforcement actions to date range from informal meetings with the offending companies to legal actions taken through the Office of the Attorney General of the Commonwealth of Massachusetts. The results have been civil penalties and agreements for judgements mandating adherence to strict compliance schedules.

The Authority's newly promulgated Administrative Penalty Regulations and Rules for Adjudicatory Proceedings will enable the Water Quality Department to be more effective in enforcement. The Authority is also establishing firmer policy and procedures which will be followed for the imposition of Civil Penalties in those future cases which require the assessment of fines.

3.3.3 TREATMENT PLANT UPGRADE PROGRAMS

Both the existing Deer Island and Nut Island Treatment Plants are being upgraded to extend the useful life of the installed facilities until the new treatment facilities can be constructed and placed into operation.

The Nut Island Immediate Upgrade Project began in January, 1983 and is expected to be completed in May, 1988. Eight projects costing approximately $12 million have been initiated to extend the useful life of the Nut Island Plant approximately ten years. Table 3.3.3-1 summarizes the eight immediate upgrade projects. Table 3.3.3-1 also describes other projects that are planned or underway to rehabilitate the existing treatment plant.

The Deer Island Treatment Plant Fast-Track Improvementss Program consists of several projects to raise the operating efficiency of the existing plant to an acceptable level. The construction of these upgrading projects started in June, 1986 and is expected to be completed in March, 1990. The Deer Island Fast Track Improvements Program is summarized in Table 3.3.3-2. Other projects that are expected to improve the service life of the existing facilities on Deer Island are also described in Table 3.3.3-2. These rehabilitation projects also include upgrading the remote headworks facilities which function as an integral part of the Deer Island Treatment Facilities.

TABLE 3.3.3-1

NUT ISLAND IMMEDIATE UPGRADE

o Power

- Rebuilding of one engine generator
- Installation of 2000 kw transformer for purchased off-site power to the site

o Preliminary Treatment

- Addition of influent flow meter (sonic type) on the High Level Sewer
- Installation of new ventilation system, odor control equipment, and explosion-proof electrical components to the grit facility
- Removal of comminutors downstream from the grit chambers
- Rebuilding of the effluent channels from the grit tanks
- Replacement of air header to the preaeration basins
- Rebuilding of one preaeration blower motor

o Primary Sedimentation

- Structural rebuilding of tanks and repairing of leaks
- Leveling of tank floors
- Replacement of all weirs
- Replacement of sludge collection equipment

o Digesters

- Replacement of outside sludge piping from the primary sludge pumps to the anaerobic digesters
- Digester roof rehabilitation

o Outfalls

- Installation of an automated sluice gate at the outfall
- Cleaning of the two main outfalls

o Electrical Distribution Substation Replacement

o Sewerage Pump Switchgear Replacement

TABLE 3.3.3-2

DEER ISLAND TREATMENT FACILITY FAST-TRACK IMPROVEMENTS

- Pump Station and Power Station Improvements
  - 5 new 90 mgd influent sewage pumps
  - 4 new 2000 Hp electric motors
  - New graphic control center to monitor sewage flow
  - New cooling water system for engines
  - New pumps for process water building
  - New heating system process water building
  - 2 new 6000 kw dual fuel, engine/generator sets
  - New switch gear/electrical distribution center
  - New fuel storage system for engines
- Rehabilitation of Digesters
  - 4 new floating roofs
  - New internal digester piping
  - New gas meters at each digester
  - New waste gas burners with meters
  - 6 new spiral heat exchangers
  - 4 new sludge hot water pumps
  - 1 new boiler
  - Rehabilitation of 2 Ingersoll-Rand gas compressors
  - A new heating and ventilating system for both the sludge thickener and the digester complexes
  - A gas detection system for both complexes
- Sludge Thickener Improvements
  - Remove existing tank mechanisms
  - Remove existing bridges, pumps, and associated piping
  - Install new thickener mechanisms and bridges
  - Install new sludge transfer system, pumps, and compressors
  - Install associated piping, electrical and control instrumentation
- Primary Sedimentation Basins Improvements
  - New grit collection system
  - New grit classification building
  - New scum concentration building

Table 3.3.3-2

DEER ISLAND TREATMENT FACILITY FAST-TRACK IMPROVEMENTS (Continued)

- New chemical feed building
- Influent and effluent sampling stations
- 80 new motorized influent sluice gates and 80 stainless steel baffles
- New flow splitter plate, to equalize grit distribution
- Structural repairs to the sedimentation basins and bridges
- 48 new stainless steel aeration leaders and diffusers
- 3 new air compressors for the aeration channels

o Chlorine Rehabilitation

- 8 new evaporators
- 8 new chlorinators
- 2 new scale systems
- New HVAC system
- New roof
- New piping and distribution system for chlorine and process water

o Electrical Upgrade

- 4 new electrical distribution substations
- New conduit for substations
- New motor control centers throughout Deer Island

o Dual Fuel/Generator Overhaul

- Overhaul of 5 diesel enginers 1000 Hp
- Overhaul of 4-700 kw generators

o Deer Island Remote Headworks Improvements
(Columbus Park, Chelsea Creek, and Ward Street)

- New grit collection and removal equipment for all 12 channels (four at each facility)
- New climber-type mechanical screens
- New HVAC equipment
- New odor control equipment
- Improvements to electrical systems
- Monorails, hoists and bridge cranes
- Hydraulic power units for sluice gates

Table 3.3.3-2

DEER ISLAND TREATMENT FACILITY FAST-TRACK IMPROVEMENTS (Continued)

o Winthrop Terminal Headworks Improvements

- Three climber-type mechanically cleaned bar screens
- Grit collection equipment
- Three inlet sluice gate operators and hydraulic power system
- Overhaul six sewage pumps (4-16,000 gpm and 2-32,000 gpm)
- Six new drive motors and controls
- Screening discharge enclosure
- Two stair access/egress towers

3.3.4 INTERIM RESIDUALS MANAGEMENT PROGRAM

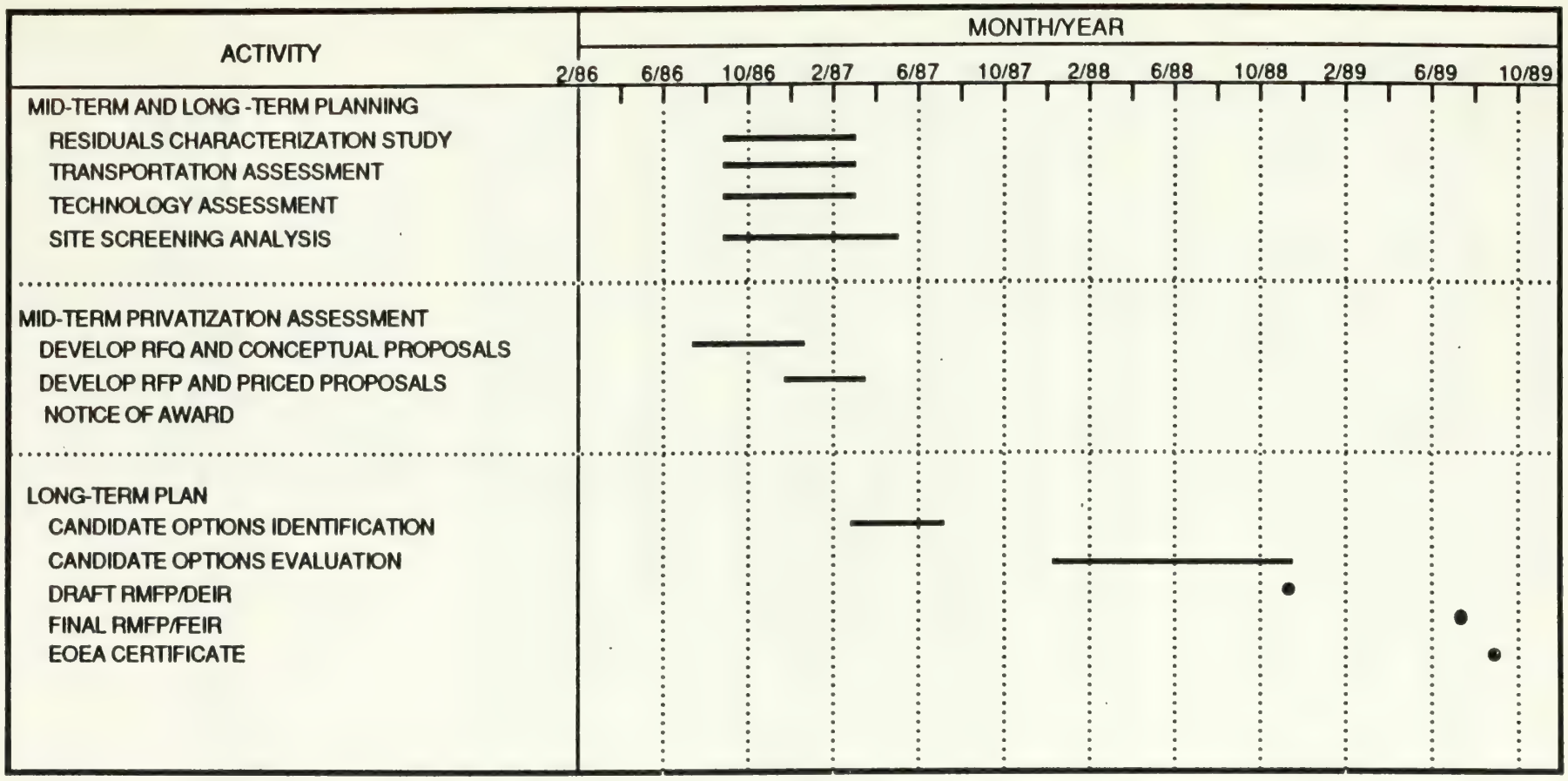
The Interim Residuals Management Program is intended to provide the facilities necessary to cease the discharge of sludge to the ocean by 1991, and to provide land based disposal of sludge until the long term management facilities now being planned are constructed in 1995. The Interim Residuals Management Program includes sludge from both the Deer Island and the Nut Island Treatment Plants. MWRA has selected New England Fertilizer Co. to construct and operate the interim sludge facilities for both the Deer and Nut Island plants. The operation will consist of barging liquid sludge from each of the plants to the Quincy Shipyard for dewatering and pelletizing. The dried pellets will be transported by rail to southern states for incorporation in fertilizer products.

A second component of the Interim Residuals Management Plan is interim scum management. Scum is the floatable material that is skimmed from the surface of sedimentation facilities at both treatment plants. Scum is currently mixed with the sludge and discharged to the Harbor. Because these materials are the more obnoxious and visible discharge to the Harbor, the removal of these materials has been given the highest of priorities. For the interim period at Nut Island, scum screening, chemical conditioning and landfill disposal was selected as the recommended scum handling option. Design of these facilities was initiated in May, 1987. At Deer Island, the recommended plan for termination of scum discharges involves a one year demonstration project. This project includes chemical fixation of all Deer Island scum by a private contractor with storage on-island. Initiation of this period is anticipated in May, 1988. At the end of the one year demonstration, a decision will be made to build permanent facilities or to continue with a service contract.

A third component of the interim residuals management plan is a composting pilot plant. Composting stabilizes organic materials and destroys bacteria and viruses in sludge. Composted sludge has the potential for use as a soil supplement for production of turf grass, horticultural uses at green houses, use as a low-grade fertilizer or use as a landfill cover material. The pilot plant was initiated in 1984 and currently processes 15 dry tons per week of sludge. The pilot plant serves the dual purpose of reducing the quantity of sludge discharged to the harbor and at the same time provides a compost product to test and develop a market for the material in the greater Boston area. The compost pilot also provides valuable information for the assessment of the viability of composting as a long-term residuals management option.

3.3.5 LONG-TERM RESIDUALS MANAGEMENT FACILITIES PLAN

The facilities planning for the long term management of residual solids is being conducted concurrently with this planning effort. The planning effort includes assessment of the quantity and quality of Deer Island and Nut Island sludge, survey of available sludge processing and transport technologies, selection of appropriate technologies, screening of potential disposal sites and selection of optimum facilities and sites. Design and construction will include both on-island and mainland facilities. The facilities planning is scheduled for completion in 1989. Figure 3.3.5-1 illustrates the general flow of planning activities for the residuals management facilities plan.



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FIGURE 3.3.5-1
RESIDUALS MANAGEMENT PROJECT SCHEDULE

3.3.6 WATER TRANSPORTATION FACILITIES

The Water Transportation Program includes the construction of the piers and related facilities to move materials, workers and equipment to and from Deer Island for the construction of the new treatment facilities and at Nut Island to support construction of the new headworks facility. Facilities planning for both on-island and on-shore piers is essentially complete. On-island piers are now being designed. Construction of these essential facilities is expected to commence in August, 1988 and to be completed in September, 1989. Construction of the on-shore piers is expected to start in September, 1988 and be completed in May, 1990. See Figure 3.3.6-1 for a schedule of water transportation facilities planning.

3.3.7 COMBINED SEWER OVERFLOW PROGRAM

MWRA is currently evaluating a means of abating pollution from combined sewer overflows. Figure 3.3.7-1 denotes the overall facilities planning for the CSO program.

3.3.8 HARBOR RESEARCH AND MONITORING

The ultimate goal of this project is the design and implementation of a plan for action directed towards cleaning up Boston Harbor and protecting the Harbor in the future.

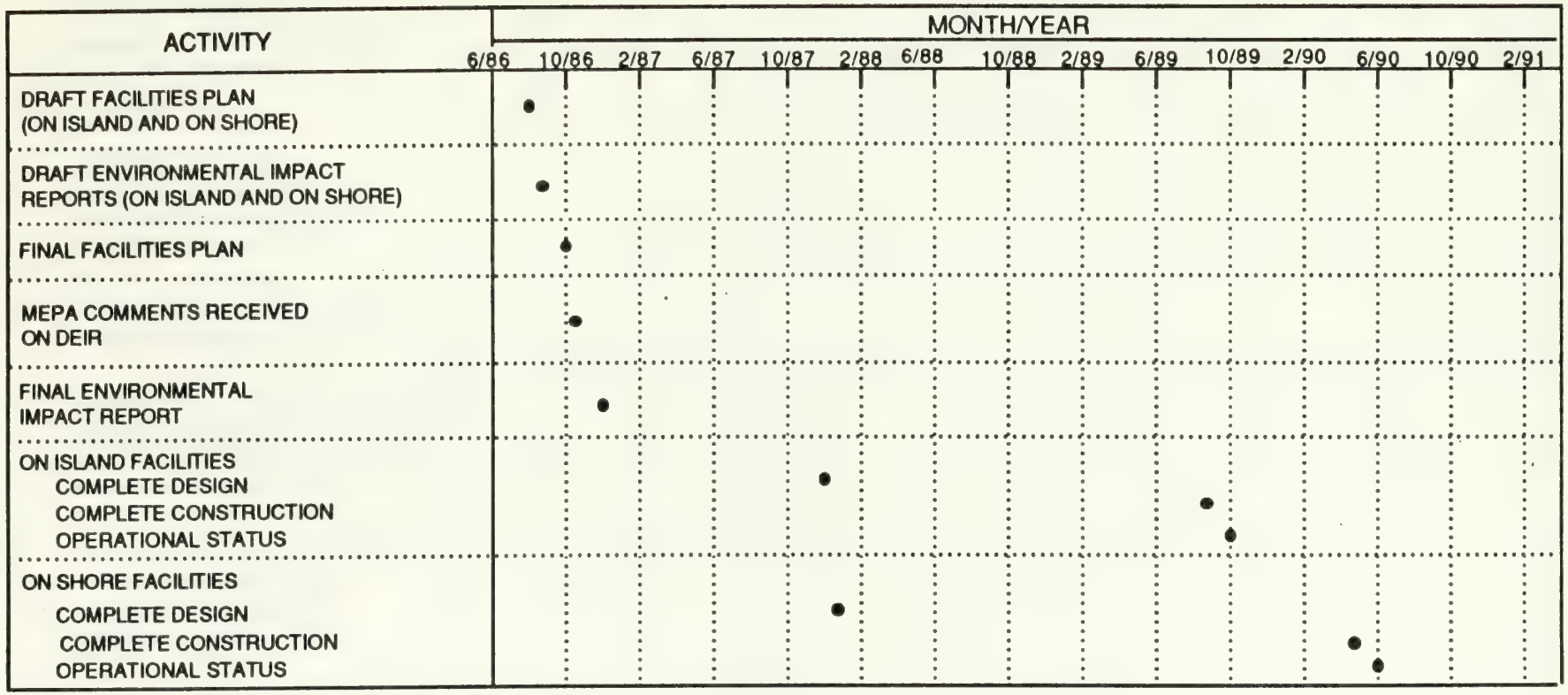
A Technical Advisory Group (TAG), established in 1986, produced a "Study Plan for Basinwide Management of the Boston Harbor/Massachusetts Bay Ecosystem." This plan defined the goals for research and monitoring in Boston Harbor and Massachusetts Bay that will be closely tied to management issues. The study plan further identified many issues facing environmental managers. Of these issues, five have been identified as high priority, requiring a well-focused scientific study.

3.3.9 WASTEWATER TRANSPORT PROGRAM

MWRA member communities discharge their wastewater through 1825 connections and 5400 miles of local sewers to 228 miles of MWRA sewers and 10 MWRA pump stations. In 1976, the EMMA study recommended approximately $855 million in improvements to sewers through the year 2000. Since 1976, the sewer relief program has informally taken on a definition involving four major projects:

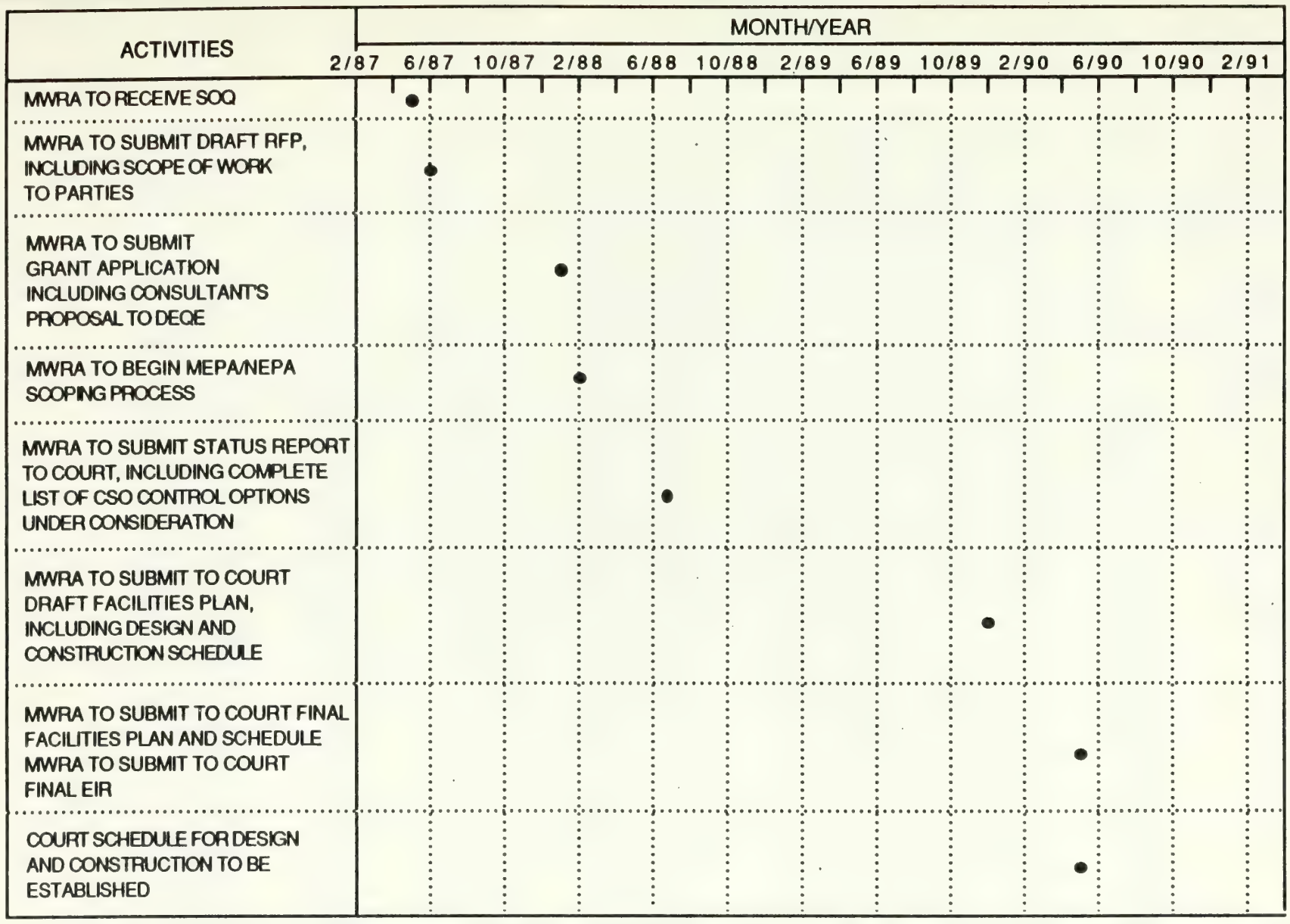
Braintree-Weymouth Relief Sewer
New Neponset Valley Relief Sewer
Framingham Extension Relief Sewer
Wellesley Extension Relief Sewer

Progress has been slow on the four major projects due to the complex and controversial nature of each project. The MWRA has, however, demonstrated success with the following projects either under construction or completed:



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FIGURE 3.3.6-1
WATER TRANSPORTATION FACILITIES
PROJECT SCHEDULE



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FIGURE 3.3.7-1
COMBINED SEWER OVERFLOWS PROJECT SCHEDULE

Millbrook Valley Relief Sewer
Reading Pumping Station
Reading Extension Sewer
East Boston Pumping Station
Hingham Force Main

The Water Transport Program is moving forward, with the potential downstream impacts of the utmost concern. The Southern System Modeling Project, which is now underway, is the first major step in this process.

MWRA plans to participate in a joint public and private effort to establish a Harbor monitoring and research program. The program will conduct research that will report on existing conditions and measure incremental change as the residuals management program and treatment plant upgrading are implemented. The priority areas to be studied include: (1) sources and fate of contaminants; (2) effects of contaminants and the health of the living resources; (3) nutrient enrichment; (4) economic, legal, political and social science assessment and; (5) public health impact. The study of these areas requires both short term projects designed to answer particular questions and a monitoring program that will determine long term impacts of human activities on the marine ecosystem. The technical results produced by these studies should be used in multiple-use management endeavors conducted by several agencies.

3.4 PROJECT MILESTONES

Though pollution of Boston Harbor has been a matter of public concern since the late 1960s, awareness was heightened in December of 1982 when the City of Quincy filed a lawsuit against the Metropolitan District Commission and the Boston Water and Sewer Commission (BWSC). Quincy sought relief from the pollution of Quincy Bay, which it claimed was resulting from the discharges of untreated and partially treated sewage from Nut Island and Moon Island.

As a result of this suit and the recommendations of the court-appointed special master, a bill was filed to remove sewer responsibilities from the MDC and to place them in a financially and organizationally independent public authority. On December 19, 1984, the Massachusetts Water Resources Authority was created.

On the following day, the EPA announced its intention to take additional action to help secure a harbor cleanup and brought suit in federal court, requesting a set of deadlines for pollution control projects. Filed at the end of January, 1985, the suit named four defendants: the MDC, the MWRA the state and the BWSC.

As a result of this lawsuit, on May 8, 1986 the United States District Court of Massachusetts imposed "major milestones" as long-term target dates to assist facilities planners toward the completion of primary and secondary treatment facilities. These dates are as follows, with milestone dates relating to this facilities plan in bold type:

Design and Construction of Piers and Staging Areas and Facilities Planning

On-Island

a. Complete Design	12/87
b. Bid Construction	5/88
c. Award Construction	8/88
d. Complete Construction	9/89
e. Attain Operational Status	10/89

On-Shore

a. Complete Design	1/88
b. Bid Construction	6/88
c. Award Construction	9/88
d. Complete Construction	5/90
e. Attain Operational Status	6/90

Facilities Planning

a. Project Start	**5/86**
b. File ENF	**6/86**
c. Complete Draft Facilities Plan	**9/87**
d. Complete Draft EIR	**11/87**
e. Complete Final Facilities Plan	**12/87**
f. Complete FEIR	**2/88**
g. Complete Environmental Review	**4/88**
h. Accept Facilities Plan	**5/88**

Construction of Treatment Plant, Outfall, and Inter-Island Wastewater Conveyance System

a. Initiate construction of new primary treatment facilities	12/90
b. Complete construction and commence operation of new primary treatment facilities	7/95
c. Initiate construction of outfall	7/91
d. Complete construction of outfall	7/94
e. Initiate construction of inter-island wastewater conveyance	4/91
f. Complete construction of inter-island wastewater conveyance	12/94
g. Initiate construction of secondary treatment facilities	during 1995
h. Complete construction of secondary treatment facilities	during 1999

At the completion of this Facilities Plan, the 1986 Court order allows for the re-examination of these long-term target dates for the design, construction, and completion of all associated court-ordered facilities.

Section 3 References

G.L.C. 30 Section 61, Findings by the MWRA on the Selection of Deer Island as the Site for Wastewater Treatment Facilities in Boston Harbor.

Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, January 1, 1987. Project Update Boston Harbor Cleanup Effort, prepared by Steven G. Lipman.

Massachusetts Water Resources Authority, November, 1985. Final Environmental Impact Report on Siting of Wastewater Treatment Facilities for Boston Harbor.

City of Quincy v. Metropolitan District Commission No. 138477, Superior Court, August, 1983, Report of the Special Master Regarding Findings of Fact and Proposed Remedies.

Technical Advisory Group For Boston Harbor and Massachusetts Bay, Massachusetts Executive Office of Environmental Affairs, July, 1986. Study Plan For Basinwide Management of The Boston Harbor/Massachusetts Bay Ecosystem.

SECTION 4.0 BASIC PLANNING CRITERIA

4.1 PLANNING PERIOD

The planning period used in this facilities plan is from the present through the year 2020. This represents the first twenty years of operation of the secondary plant which has been stipulated by the federal court to be in operation not later than the end of 1999. The use of twenty-year planning periods is considered generally accepted practice in the engineering profession, and is required by facilities planning regulations issued by the U.S. Environmental Protection Agency (EPA).

4.2 SERVICE AREA

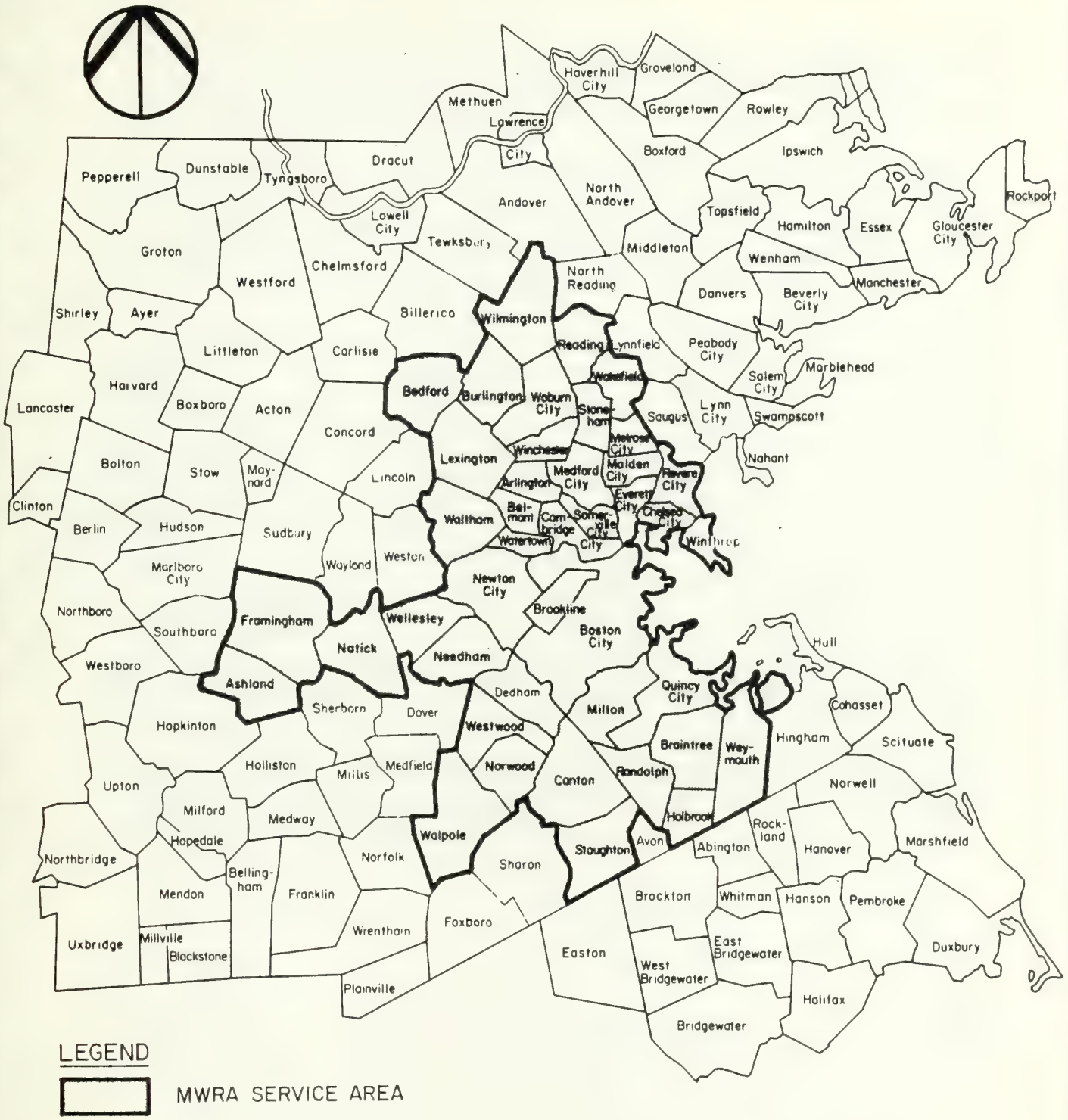
Under its enabling legislation, MWRA is charged with providing treatment to the wastewaters generated in 43 municipalities and special districts. The legislation permits permanent sewer service to other communities, but only after these communities have shown that no feasible alternatives exist, and after numerous regulatory and legislative approvals have been obtained.

Expansion of the service area, if it takes place, will occur at the boundaries of the existing service area. Figure 4.2-1 shows the existing service area, together with communities which are adjacent to the boundary of the area. Most of the communities abutting the Authority's service area are already served by a wastewater system. Any system expansion which might be considered would be on a very limited basis due to existing wastewater utilities on the perimeter of the MWRA service area. Therefore, in developing population and flow projections, the existing service area was used as a base.

Currently, MWRA owns and operates two wastewater treatment plants, one at Deer Island and the other at Nut Island, which handle wastes from the North and South Metropolitan Sewer Service Areas. Some communities in the service area are serviced by both plants. At present, the system provides preliminary and primary treatment, which consist of screening and grit removal, sedimentation, and chlorination. Both the treated effluent and concentrated, digested sludges are discharged into Boston Harbor.

The Nut Island Facility (servicing the South System) has been in operation since 1952 and presently serves the following twenty-one communities:

Ashland	Hingham (N. Sewer Dist.)	Quincy
Boston (portion)	Holbrook	Randolph
Braintree	Milton (portion)	Stoughton
Brookline (portion)	Natick	Walpole
Canton	Needham	Wellesley
Dedham	Newton (portion)	Westwood
Framingham	Norwood	Weymouth



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FIGURE 4.2-1
MWRA SERVICE AREA

The Southern System encompasses an area of approximately 240 square miles and presently has a total population of approximately 750,000 and a contributing population of approximately 630,000. Five MWRA pumping stations are located throughout the South System contributing area.

The Deer Island Facility (servicing the North System) has been in operation since June, 1968 and serves twenty-six communities. The area served by this treatment plant is approximately 170 square miles with a total population of approximately 1,300,000 and a contributing population of approximately 1,250,000. Six MWRA pumping stations are located throughout the North System contributing area. Member cities and towns include:

Arlington	Lexington	Stoneham
Bedford	Malden	Wakefield
Belmont	Medford	Waltham
Boston (portion)	Melrose	Watertown
Brookline (portion)	Milton (portion)	Wilmington
Burlington	Newton (portion)	Winchester
Cambridge	Reading	Winthrop
Chelsea	Revere	Woburn
Everett	Somerville	

4.2.1 DATUM PLANES

The base elevation to be utilized in the facilities plan is the MDC Sewer Datum. This is compatible with the datum previously used for the existing Deer Island and Nut Island treatment facilities.

Various datum planes are used in the Boston area, most commonly Mean Sea Level Datum (USGS datum of 1929), Boston City Base, and the MDC Sewer Datum. The relationship of the various datums to the MDC Sewer Datum are shown below:

DATUM PLANES

To Convert From	To	Add
USGS Datum	MDC Sewer Datum	105.62 ft
Boston City Base	MDC Sewer Datum	99.97 ft

4.3 CRITERIA FOR PRELIMINARY EVALUATION OF UNIT PROCESSES

In order to screen the unit processes considered for wastewater treatment at the proposed Deer Island facilities, screening criteria were developed. Each unit process was first evaluated on the basis of area requirements, experience, performance at large municipal wastewater treatment facilities, and relative capital and operating costs. Following this evaluation, each unit process was then compared to a reference unit process that accomplishes the same function, using 14 additional criteria. The comparison was done with specific reference to the functioning of the processes at the Deer Island and Nut Island sites, and may not necessarily represent the evaluation of other treatment facilities or a generic comparison of unit processes. The unit processes were examined in four function areas: preliminary treatment, primary treatment, secondary treatment, and disinfection. The reference processes for preliminary treatment were aerated grit chambers and catenary screens; for primary treatment, circular clarifiers; for secondary treatment, air activated sludge and circular secondary clarifiers; and for disinfection, the use of liquid chlorine.

4.3.1 SCREENING CRITERIA

The following paragraphs define each criterion and describe how the criterion was used to screen unit processes. Table 4.3.1-1 summarizes the evaluation criteria and ratings.

Area Requirements

Area requirements were estimated for each unit process by use of process sizing criteria. The criteria for each unit process are presented in the following sections. A plant average day flow of 500 mgd was utilized to determine the volume and/or surface area required. Since all unit processes require multiple units, the space between units was taken into account in the area requirements. However, the total area presented does not include area for support support facilities, roadways, or interprocess flow conveyance. Unit processes requiring significantly more area than the reference unit process will likely be eliminated from further consideration since land area available at Deer Island is limited.

Municipal Wastewater Experience and Performance

The experience and performance of each unit process at large municipal wastewater treatment facilities were evaluated. Some of the information reviewed included the number of years of operation, size of facilities, history of operation and maintenance, problems encountered, ability to handle peak flows, and performance as measured by process effluent quality. If a unit process had not been demonstrated successfully at a large municipal wastewater treatment facility, it was not selected for detailed evaluation.

TABLE 4.3.1-1

SUMMARY OF EVALUATION CRITERIA FOR UNIT PROCESS EVALUATION

Evaluation Criteria	Rating		
Reliability	low	average	high
Flexibility	low	average	high
Constructibility	difficult	normal	-
Safety	special	normal	-
Operators Required	more	average	less
Operational Complexity	difficult	average	simple
Power Efficiency	low	average	high
Auxiliary Needs	(no auxiliary need or specific need)		
Residuals Aspects	difficult	average	simple
Spoils Disposal	difficult	average	simple
Air Emissions Control	difficult	average	simple
Noise Control	difficult	average	simple
Aesthetics	-	average	good
Effluent Quality	low	average	high

Capital Costs and Operation and Maintenance Costs

For both of these cost criteria, the unit processes were compared on the basis of relative costs. The basis of comparison was the reference unit process presented above. Several sources were used to develop relative costs including published cost curves, actual bid costs, and costs supplied by manufacturers. Most unit processes that achieve the same function are similar in cost.

Only unit processes that are significantly lower or higher in costs than the reference unit process will be noted in the discussion. If the capital or operation cost of a particular unit process exceeds the reference unit cost by 50 percent, that unit process will likely be eliminated from further consideration.

Reliability

Reliability is defined as the level of assurance that the unit process will consistently achieve the required degree of treatment under the expected range of operating conditions. This criterion takes into account the track record of the unit process at other large municipal wastewater treatment facilities. For this study, unit processes are rated using one of three levels of reliability: "high," "average," or "low." Unit processes ranked "high" consistently achieve the required degree of treatment. A unit process ranked "average" can be expected to have occasional process upsets but normally meets standards and is comparable to the reference unit process. A unit process ranked "low" has a record of poor reliability or represents a new unproven process.

Flexibility

Flexibility is defined as the degree to which a unit process will operate under upset conditions or major changes in flows or loadings. An upset condition may be defined as out of normal range but anticipated. For this study, unit processes are rated using one of three levels of flexibility: "high," "average," or "low." A unit process ranked "high" is not significantly affected by upset conditions or changes in flow or loadings. Unit processes ranked "average" are sometimes affected by these conditions, and unit processes ranked "low" cannot be expected to achieve design requirements during upset conditions such as changes in flow or loadings.

Constructibility

Constructibility takes into account many aspects of the construction of a unit process. These include the degree of construction difficulty, duration, and scheduling. The constructibility of a unit process will also be influenced by the degree to which supporting barge and staging areas are required. For this study unit processes are rated as presenting "difficult" conditions for construction or presenting "normal" conditions.

Safety

Safety is a criterion used to judge the level of precautions needed to reduce risks to plant personnel or the surrounding community. For some unit processes special safety precautions are required during operation. For other unit processes only normal safety precautions are required for operation. Therefore, two levels of safety are used in rating unit processes in this report: "special" and "normal."

Operators Required

This criterion is a measure of the relative number of operators and maintenance personnel required to successfully operate and maintain the unit process as compared to the reference unit process. For this study three levels of operators required are cited: "more," which indicates a staff larger than the average required for the reference unit process; "average" number; or "less" number than the average required to operate and maintain the reference unit process.

Operational Complexity

Operational complexity is defined as the degree of difficulty in the maintenance and control of a unit process. It is directly proportional to the level of skill required by plant operators to successfully operate the unit process. Average operational complexity means the unit process requires similar skills compared to the reference unit process. For this study three levels of operational complexity are cited: "difficult," "average," and "simple." The simple rated unit process will not require as high a skill level for operators in order to operate successfully. A difficult unit process will require more highly skilled operators compared to the reference unit process for successful operation.

Power Efficiency

Within each functional area power is required to achieve the desired degree of treatment. A unit process rated as "high" for power efficiency uses less power than the reference process to achieve similar degrees of treatment. A unit process rated "average" is similar in power needs to the reference process. A unit process rated as "low" for power efficiency uses more power than the reference process to achieve similar degrees of treatment.

Auxiliary Needs

Certain unit processes require significant auxiliary support, such as plant water for washing or chemical feed facilities. Needs were noted for these unit processes. If the unit process does not require any auxiliary equipment or utilities, the notation "none" was entered.

Residuals Aspects

Residuals aspects are defined as the level of difficulty of collection, processing, and disposal of residuals. Residuals include primary and secondary sludges, scum, grit, and screenings. This criterion takes into account both the quality and quantity of residuals generated by unit processes. A unit process rated "difficult" generates a greater amount of residuals or residuals more difficult to collect, process, or dispose of compared to the reference unit process. A unit process rated "average" is similar to the reference unit process in residuals aspects. A unit process rated "simple" either generates fewer residuals compared to the reference unit process, or achieves the collection, processing, and disposal of those residuals more easily than does the reference unit process.

Spoils Disposal

Construction of unit processes will require excavation of soil and subsequent disposal at either on-island or off-island locations. Unit processes that require minimal excavation will reduce the volume of spoils requiring disposal. For this study, spoils disposal is rated as "difficult" compared to the reference unit process, "average" if it is similar to the reference unit process, or "simple" if it produces significantly less spoils than the reference unit process.

Air Emissions Control

Air emissions control is defined as the potential for generating air emissions and therefore, indirectly, as an indication of the level of control necessary to limit air emissions from a unit process. Volatile material is emitted from nearly all unit processes. Production is greater where turbulence is greater. For these unit processes the level of control is greater to minimize the effects of these emissions. For this study, a unit process rated "difficult" has a greater potential for emissions and requires a complex method to collect air emissions, or the area over which collection is required is extensive compared to the reference unit process. A unit process rated "average" emits a similar amount of pollutants and requires similar control as compared to the reference unit process. A unit process rated "simple" does not produce significant air emissions and is not normally equipped with air emission control equipment.

Noise Control

Noise control is defined as the ease of controlling the noise generated during operation of a specific unit process. For this study, a unit process rated "difficult" has a potential for a high noise level and requires a greater level of control compared to the reference unit process. A unit process rated "average" produces noise and requires noise control mitigation to about the same degree as the reference project. A unit process rated "simple" produces only low levels of noise that are simply controlled as compared to the reference unit process.

Aesthetics

Aesthetics is defined as the relative visual impact of a unit process on the surrounding communities and adjacent marine users. Unit processes are rated as either "good" or "average." A unit process ranked "good" is normally housed in a building where the building itself can be treated architecturally, or the process has a very low profile compared to the reference unit process. A unit process ranked "average" may have a high profile, may have a large amount of exposed equipment, or have other attributes that would require normal screening or other architectural treatment.

Effluent Quality

Effluent quality is defined as the relative impact of a unit process on downstream unit processes or the receiving water. A unit process rated "high" achieves results better than the reference unit process. A unit process rated "average" is similar to that achieved by the reference unit process. A unit process rated "low" does not meet the same standards as the reference unit process.

4.4 DETAILED EVALUATION CRITERIA

As part of the Secondary Treatment Facilities Plan development, major decisions will be made to select a wastewater treatment process; to size and locate conduits and pumping stations to convey wastewater to, and treated effluent from, the Deer Island Treatment Facility; and to plan the initial site preparation program at Deer Island. The purpose of this section is to describe the criteria that will be used to evaluate alternatives. These criteria include the criteria used during earlier screening of unit processes as well as additional criteria applicable to the detailed analysis. Evaluation criteria for outfall selection will be finalized at a later date following discussions with interested parties. Evaluation criteria for residual management and combined sewer overflows are subjects of separate facilities plans.

The remaining project components include the plant, the inter-island wastewater conduit, and site preparation. Table 4.4-1 lists all of the evaluation criteria and their respective indicators.

Certain criteria are common to all of the project components. They are presented in Section 4.4.1. Sections 4.4.2 through 4.4.4 describe criteria specifically applicable to each of the other project components as follows:

Section 4.4.2 Specific Criteria for Evaluation of Wastewater Treatment Alternatives

Section 4.4.3 Specific Criteria for Evaluation of Inter-Island Wastewater Conveyance System Alternatives

Section 4.4.4 Specific Criteria for Evaluation of Site Preparation Alternatives

TABLE 4.4-1

SECONDARY TREATMENT FACILITIES PLAN
PROPOSED CRITERIA FOR DETAILED EVALUATION OF ALTERNATIVES

Criteria	PROJECT COMPONENTS: Wastewater Treatment Plant	Inter-Island Conveyance	Early Site Preparation	Indicators
COST				
Present Worth Costs	X	X	X	Millions of Dollars
Capital Costs	X	X	X	Millions of Dollars
Annual Operation and Maintenance Costs	X	X		Millions of Dollars Per Year
TECHNICAL				
Area Requirements	X	X	X	Acres
Reliability	X	X		Acceptable, High
Flexibility	X	X	X	Acceptable, High
Constructibility	X	X	X	Aggravated, Moderate, Minimal
Personnel Safety	X			Special, Typical
Staffing Requirements	X			Number of Personnel
Operational Complexity	X			Difficult, Modest Typical
Power Needs	X		X	Millions of Dollars Per Year

TABLE 4.4-1

SECONDARY TREATMENT FACILITIES PLAN
PROPOSED CRITERIA FOR DETAILED EVALUATION OF ALTERNATIVES
(Continued)

Criteria	PROJECT COMPONENTS: Wastewater Treatment Plant	Inter-Island Conveyance	Early Site Preparation	Indicators
TECHNICAL (cont)				
Chemical Requirements For Operation	X			Pounds per Day by Type
Quantity of Residuals Generated	X			Tons Per Day
Quality of Residuals Generated	X			Difficult, Modest, Typical
Quantity and Quality of Spoils	X	X	X	Cubic Yards
ENVIRONMENTAL				
Air Emission Control	X	X	X	Volume Requiring Treatment
Noise Control	X	X	X	Difficult, Modest, Minimal

TABLE 4.4-1

SECONDARY TREATMENT FACILITIES PLAN
PROPOSED CRITERIA FOR DETAILED EVALUATION OF ALTERNATIVES
(Continued)

Criteria	PROJECT COMPONENTS: Wastewater Treatment Plant	Inter-Island Conveyance	Early Site Preparation	Indicators
ENVIRONMENTAL (cont)				
Traffic	X	X	X	Number of Truck Trips per day or Significant, Modest, Minimal
Marine Resources		X	X	Significant, Modest, Minimal
INSTITUTIONAL				
Timely Implementation	X	X	X	Difficult, Modest
Permitting	X	X	X	Extensive, Modest
External Coordination	X	X	X	Extensive, Modest Minimal
Internal Coordination	X	X	X	Extensive, Modest Minimal
Demand for Unique or Scarce Resources	X	X	X	Difficult, Modest
Flexibility to Meet Project Phasing			X	None, Fair, Good

Specific criteria for the evaluation of Effluent Outfall alternatives will be discussed in Volume V, Effluent Outfall.

The description of these criteria will enable the reader to understand how a particular criterion will be used to rate an alternative. No weighting factors have been assigned to any of the criteria. The alternatives will not be ranked. Rather, the criteria will be used to display sufficient information about each alternative so that decisions can be made in selecting the recommended plan.

Tables 4.4.5-1 and 4.4.5-2 in the next section describe how the criteria used during the siting of this plant and MWRA's previous commitments to mitigation are incorporated in the evaluation criteria.

4.4.1 COMMON EVALUATION CRITERIA

The evaluation criteria that are common to all project components are as follows:

Air Emissions Control

Air emissions control is defined as the potential for generating odor/air emissions and therefore, indirectly, as an indication of the level of control necessary to limit air emissions from wastewater treatment, transport and site preparation activities. For each alternative, the total volume of air requiring treatment will be estimated. The ambient concentration of emissions including odors and their impact on plant personnel and neighboring communities will also be evaluated in accordance with State guidelines.

Noise Control

MWRA has committed to a program to comply with stringent noise mitigation and to develop a program to avoid adverse noise impacts during construction and operation. Since all alternatives will meet these commitments this criterion is defined as the ease of controlling the noise generated during construction and operation. Wastewater project component alternatives rated "difficult" have a potential for high noise levels and require a greater level of control. An alternative rated "modest" produces noise and requires noise control mitigation to about the same degree as typical wastewater transport and treatment facilities or as typical site preparation projects. Alternatives may be rated "low" if little or no noise control is required.

Environmental

This set of criterion measures a project component's effect on selected environmental items. The list below is based on EPA guidance for facilities planning. Each alternative will be evaluated (where applicable) for impacts to:

- Historical and archaeological sites
- Floodplains, wetlands and barrier beaches
- Fish and wildlife protection

- o Endangered species protection
- o Recreational opportunities

Alternatives will be rated as having "minimal," "modest," or "significant" effect.

Traffic

MWRA has committed to limit the traffic through Winthrop during both construction and operation of the treatment facilities. As a major element of that committment, MWRA is in the process of contracting a pier facility for the movement of materials by either barging or roll/on-roll/off, a process in which trucks loaded with material are driven onto barges, then driven off the barges and unloaded at a specific site. Where differences exist among alternatives in the amount of equipment or materials to be transported to the site, the number of trick trips and/or barge trips for personnel, materials, and equipment during construction will be estimated. Differences will also be shown for the number and type of trips required during operation.

Area Requirements

For each project component, alternative preliminary layouts will be prepared. For the wastewater treatment alternatives, all processes require multiple units, therefore, the space between processes will be taken into account in determining total process area. Areas for ancillary facilities, roadways and interprocess conveyance will be added to the process area. For other project components (transport, outfall and site preparation), area requirements for alternatives will also be presented.

Quantity and Quality Of Spoils for Disposal and/or Relocation

Construction of new transport and treatment facilities will require the movement of large quantities of soil and its subsequent disposal/use at either on-island or off-island locations. For this study, the total volume (yd^3) of spoils requiring movement and the volume (yd^3) requiring offsite disposal and/or reuse will be presented for each alternative. In addition, material that will require offsite disposal will be assessed as to the type and quality of material and the difficulty expected in ultimately disposing of this material.

Timely Implementation

Implementation is defined as the relative difficulty expected in maintaining the schedule for installation and/or expansion of the system in discrete, manageable components. For this study, two ratings are appropriate for this criteria: "moderate" and "difficult." For alternatives with features likely to make implementation difficult or to cause project delays, the "difficult" rating is used. For other alternatives with fewer challenges, the "moderate" rating is used.

Permitting

Permitting is defined as the measure of the relative difficulty in obtaining the necessary permits for an alternative. The alternatives will be rated "moderate" or "extensive" reflecting the relative time required to obtain a permit.

External Coordination Requirements

External coordination requirements are a measure of the relative degree to which the Authority must interact with other organizations to achieve the desired objectives. This includes consideration of legislative approval and other requirements necessitated by legal and jurisdictional limits to MWRA's authority. Alternatives are rated "minimal," "modest," or "extensive," depending on the degree of coordination required.

Internal Coordination Requirements

Internal coordination requirements are a measure of the relative degree of coordination required between Authority projects or programs such as the coordination required between the wastewater treatment section and the industrial waste section. Alternatives are rated "minimal," "moderate," or "extensive," depending on the degree of coordination required.

Demand For Unique Or Scarce Resources

This criterion is a measure of the demand that any one alternative may put on resources that are in scarce supply or not available in the local area. Key shortages of some labor skills and equipment may occur because of the concurrent construction of major projects such as the third harbor tunnel. Alternatives are rated "moderate" if potential conflicts exist, or "difficult" if demands clearly exceed supply.

Present Worth Costs

Present worth costs are the sum of those costs which, if invested now at a given interest rate, would provide exactly the funds required to construct and operate the project for the planning period. Present worth costs for each project component alternative will be presented in terms of millions of dollars. The design year of the project is 2020, twenty years after the planned startup of secondary treatment facilities and 25 years after the planned startup of new primary treatment facilities.

Capital Costs

Capital costs of alternatives will include costs to construct facilities, costs for equipment replacement during the planning period plus 35 percent to cover construction contingencies, administrative, engineering and legal costs. Any significant and special mitigation cost will be included in the alternative costs. Construction costs of necessary facilities in this plan do not include costs for land purchase. Financing, legal and administrative costs to implement the project will be presented only for the recommended plan. Capital costs will be presented in terms of millions of dollars.

Annual Operation And Maintenance Costs

Operating costs will include power, labor, chemical and utility costs and the cost of supplies. Power costs will include consideration of power company demand charges and credit for power produced on-site. Labor costs will be based on average salary levels including employee benefits. Annual operation and maintenance costs will be presented in terms of millions of dollars per year.

4.4.2 SPECIFIC CRITERIA FOR EVALUATION OF WASTEWATER TREATMENT ALTERNATIVES

The specific evaluation criteria that will be used for evaluation of treatment alternatives are described below.

Reliability/Flexibility

Reliability/Flexibility is defined as the degree to which a wastewater treatment alternative will accomodate an anticipated upset or a significant, generally unanticipated, equipment failure and still meet treatment standards. Overall flexibility will be a function of the design criteria selected for individual unit processes. This criterion is judged using the existing record of municipal wastewater experience and performance for individual unit process. Wastewater treatment alternatives are rated using one of two levels of reliability/flexibility: "acceptable" and "high." An alternative ranked "high" consistently achieves and frequently exceeds the required degree of treatment. An alternative ranked "acceptable" can be expected to have occasional process upsets but will continuously meet standards.

Constructibility

Constructibility takes into account many aspects of the construction of treatment facilities. These include the degree of construction difficulty, construction duration, and impacts on overall scheduling. Construction work will be divided up into appropriate packages depending on factors such as special labor skills required, degree of instrumentation or mechanical equipment installation. The number of work packages or contracts may impact the project schedule. For this study, wastewater treatment alternatives are rated as presenting "aggravated" conditions for construction, or as presenting "minimal" conditions for construction.

Personnel Safety

Safety is a criterion used to judge the level of precautions needed to reduce risks to plant personnel or to the surrounding community. For some unit processes special safety precautions are required during operation. For other unit processes only normal safety precautions are required for operation. Therefore, two levels of safety are used in rating unit processes in this report: "special" and "typical."

Staffing Requirements

This criterion identifies the approximate number of operators and maintenance personnel required to successfully operate and maintain a particular alternative wastewater treatment process. Management, supervisory and laboratory personnel needs will be about the same for each alternative and will be estimated for the recommended plan.

Operational Complexity

Operational complexity is defined as the degree of difficulty in the maintenance and control of a unit process. It is directly proportional to the level of skill required by plant operators to successfully operate the unit process. Average operational complexity means the unit process requires similar skills as compared to the reference unit process. For this study three levels of operational complexity are cited: "difficult," "modest," and "typical." The "typical" rated unit process will not require as high an operator skill level for successful operation. A "difficult" unit process will require more highly skilled operators to achieve successful operation compared to the reference unit process.

Power Needs

Within each functional area power is required to achieve the desired degree of treatment. (Preliminary treatment, primary treatment, secondary treatment and clarification, disinfection, and influent and effluent pumping.) For each alternative the total power required will be presented in kilowatts.

Quantity of Residuals Generated

Residuals refer to the sludge, screenings, grit and scum removed from the wastewater during treatment. These residuals require processing and disposal. For each alternative the total weight or volume of residuals, by type, will be presented.

Quality of Residuals Generated

Since all wastewater treatment alternatives treat the same influent, the quality of residuals generated will be generally similar. However, different unit processes may remove residuals in a manner that affects their characteristics. This may impact the degree of difficulty in processing or disposing of residuals. For this criterion, a unit process that generates residuals that are more difficult to manage than those of a typical secondary treatment facility will be identified. The three levels of residuals quality cited are "typical" and "difficult."

Chemical Requirements for Operation

For those alternatives requiring chemicals, the type and quantity will be presented. The quantity will be presented in terms of pounds per day, or in other appropriate measurements. Hazardous chemicals will be identified and chemical requiring any special handling will be identified.

Visual Impacts

This criterion addresses the visual impact of the wastewater treatment facilities both at deer island and the headworks facility at nut island. The current profile of Deer Island includes the central drumlin which rises 100 ft above water level, the existing plant, the prison, and other natural and manmade features. The current profile of Nut Island is dominated by the existing plant. The visual impact is assesed as resulting in "minimal," "modest," or "significant" change to the Islands. At Deer Island the impact is evaluated from several points of view: the nearby residents of Point Shirley; the more distant residents of the town of Winthrop; and a view from the west or southwest which could represent a view

from Boston or from marine users of Boston Harbor. At Nut Island the impact is evaluated from Hough's Neck and the Quincy shoreline.

Flexibility to Meet Future Changes

This criterion evaluates the wastewater treatment alternatives according to the relative ease with which they could be modified to accommodate future changes in treatment standards. The ease of adaptation is assessed as either "none," "fair," or "good."

4.4.3 SPECIFIC CRITERIA FOR EVALUATION OF INTER-ISLAND CONVEYANCE SYSTEM ALTERNATIVES

In this section, evaluation criteria that will be used in the detailed evaluation of inter-island conveyance system alternatives will be described. The major alternatives being studies are a buried pipeline, a deep rock tunnel, or a combination of methods that will transport wastewater from the Nut Island headworks facility to the Deer Island plant.

Reliability

Reliability is defined as the level of assurance that the inter-island conveyance system will continuously operate over the expected range of operating conditions throughout the life of the project. Reliability is a criterion in selecting and arranging active components of the system such as electrical and mechanical equipment. Reliability is not a criterion in selecting and arranging passive components of the system such as structures, buried pipelines, and tunnels.

The reliability of pumping station equipment alternatives are rated using two levels: "acceptable" and "high." Alternatives ranked "high" are expected to operate continuously without system impact. Alternatives ranked "acceptable" can be expected to have infrequent equipment outages. In all cases, however, back-up pumping capacity will be available from standby units.

Flexibility

Flexibility is defined as the degree to which a hydraulic conveyance system alternative will accommodate an upset or a significant, generally unanticipated, equipment failure. An upset condition may be defined as other than normal, but anticipated. For this study, alternatives are rated using one of three levels of flexibility: "low," "medium," or "high." Alternatives ranked "high" are not significantly affected by upset conditions. Alternatives ranked "medium or "low" are sometimes affected by these conditions but will meet standards.

Constructibility

Constructibility is defined as the level of assurance that the inter-island conveyance system will be constructed on schedule. Constructibility is a criterion used in evaluating the transport conduit alternatives: buried marine pipeline versus deep rock tunnels. This criterion includes availability of labor skills, equipment and materials; proven, as opposed to

transport conduit alternatives: buried marine pipeline versus deep rock tunnels. This criterion includes availability of labor skills, equipment and materials; proven, as opposed to state-of-the-art, construction methods; and the impact of adverse weather. Alternatives are discribed as having "minimal," "moderate," or "aggravated" conditions for construction.

Marine Resources

Potential impacts to marine resources associated with the construction of alternative inter-island wastewater transport systems will be compared. In general, those alternatives involving construction within the marine environment may be characterized as having a "minimal," "modest," or "significant" potential for either short- and/or long-term impact to the affected resources. Impacts may be direct, such as displacement of biota or removal of benthic habitat by dredging or by marine spoil disposal, or impacts may be indirect to the marine biota by releasing potentially toxic constituents.

4.4.4 SPECIFIC CRITERIA FOR EVALUATION OF SITE PREPARATION ALTERNATIVES

The following sections described the specific evaluation criteria that will be used during the detailed evaluation of site preparation alternatives. Site preparation is defined as those construction activities required at Deer Island (e.g. removal of central drumlin, prison facilities, bunkers) before the new primary treatment facilities are constructed.

Flexibility

Flexibility is defined as the degree to which site preparation activities do not preclude the feasability of possible options for engineering, construction and operation of existing and proposed treatment facilities. Alternatives ranked "high" offer the greatest flexibility, i.e., the fewest restraints. Alternatives ranked "acceptable" indicate reduced flexibility. Alternatives rated as "limited" indicate significantly reduced ability to accomodate engineering options.

Constructibility

Constructibility takes into account many aspects of site preparation including the degree of construction difficulty, duration, access requirements, sequencing, and scheduling. Construction work will be broken into appropriate packages depending on special labor skills required and phase of work. For this study, site preparation alternatives are rated as presenting "minimal," "modest," or "aggravated" conditions for construction.

Power Needs

Power is required to support site preparation alternatives. While the quantity of power required for site preparation is small in comparison to the ultimate pumping and treatment power needs, the demand may exceed the limited onsite supply. Thus, an offsite power supply,

which currently doesn't exist, may be required early in the project. This criterion judges the amount of power required and the date by which it is required.

Quantity and Quality of Spoils for Disposal and/or Relocation

Construction of new transport and treatment facilities will require the movement of large quantities of soil and its subsequent disposal/use at either on-island or off-island locations. For this study, the total volume (cubic yards) of spoils requiring movement and the volume (cubic yards) requiring offsite disposal and/or reuse will be presented for each alternative. In addition, material will require offsite disposal will be assessed as to the type and quality of material and the difficulty expected in ultimately disposing of this material.

Special Resources

Site preparation may require the removal or relocation of special resources such as historic structures and archaeological resources. An alternative which minimizes removal and maximizes reuse/relocation of resources that are removed is described as "minimal." An alternative which may require more infringement of these resources is described "modest." An alternative that requires significant infringement on these resources is described "significant."

Flexibility to Meet Project Phasing

This criterion evaluates the site development alternatives according to the relative ease with which they could be modified to accomodate larger area requirements for wastewater treatment as dictated by changes in treatment standards. The ease of adaptation is assessed as either "none," "fair," or "good."

4.4.5 APPLICABILITY OF OTHER CRITERIA AS DETAILED EVALUATION CRITERIA

During siting of the wastewater treatment plant, MWRA developed eight criteria to assist in site selection. Table 4.4.5-1 provides a description of each siting criteria and a statement of its applicability for use as evaluation criteria.

A significant mitigation package was developed as an integral part of MWRA's decision to site the new secondary treatment facilities on Deer Island. Because MWRA is committed to alleviating the impacts associated with the construction and operation of the treatment facilities, the previous mitigation commitments are also an integral part of the facilities planning process.

Table 4.4.5-2 provides a summary description of each of the mitigation commitments, and a statement of the applicability of each commitment for use as an evaluation criterion.

TABLE 4.4.5-1

APPLICABILITY OF PLANT SITING CRITERIA AS EVALUATION CRITERIA

SITE SELECTION CRITERIA	APPLICABILITY OF CRITERIA
1. Reliability Measures the ability of each alternative to promote the overall integrity of the wastewater treatment system.	Reliability considerations are included in treatment, inter-island transport, and outfall evaluation criteria.
2. Effect on Neighbors Measures each alternative's impact on those in close proximity to the treatment plant and on those affected by the construction of the facility. Impacts analyzed were odor, noise, property values, and health and safety.	Odors, noise, visual affects, and health and safety considerations are included in evaluation criteria for the pertinent project components. The remaining considerations are discussed in the section on mitigation commitments.
3. Equitable Distribution Of Regional Responsibility Measures the degree to which any one community is asked to shoulder a disproportionate share of the impacts associated with living and working in a major metropolitan area.	This criterion is not considered for the project components involving treatment, wastewater transport to Deer Island, and site preparation. It may be used in development of outfall siting criteria.

TABLE 4.4.5-1

APPLICABILITY OF PLANT SITING CRITERIA
AS EVALUATION CRITERIA
(Continued)

SITE SELECTION CRITERIA	APPLICABILITY OF CRITERIA
4. Cost	
Measures the financial resources that must be invested in the facility under each alternative.	Cost criteria are described and considered in all project components.
5. Implementability	
Measures the ability of each alternative to be brought to reality in a timely and predictable manner. This criterion considered construction schedules, the permitting process, and other institutional aspects.	Implementation and permitting are considered in all project components.
6. Harbor Enhancement	
Measures each alternative's consistency with, and potential for, improvement of Boston Harbor's role in the economic and social life in the Greater Boston area. This criterion was used to judge which Harbor island had a greater potential for recreational opportunities.	Harbor enhancement is the goal of all the alternatives considered but is not specifically included in the evaluation criteria.
7. Effect On Natural And Cultural Resources	
Measures each alternative's effect on important resources in the Harbor. This criterion was used to weigh the relative importance of historic and archaeologic sites and barrier beaches and wetlands on the candidate Harbor Islands.	These considerations are described and considered in all project components.

TABLE 4.4.5-1

APPLICABILITY OF PLANT SITING CRITERIA AS EVALUATION CRITERIA (Continued)

SITE SELECTION CRITERIA	APPLICABILITY OF CRITERIA
8. Mitigation	
A significant mitigation package was developed as an integral part of MWRA's decision to site the new secondary treatment facilities on Deer Island. MWRA is committed to alleviating the impacts associated with the construction and operation of the treatment facilities.	The next section discusses each mitigation commitment and its applicability as an evaluation criterion for alternatives.

TABLE 4.4.5-2

APPLICABILITY OF COMMITMENTS TO MITIGATION AS EVALUATION CRITERIA

MITIGATION COMMITMENTS	APPLICABILITY OF COMMITMENTS
1. Flow and Growth	
MWRA has committed to an aggressive program to avoid overloading the new treatment facilities planned for Deer Island, and to avoid future expansion to the extent possible. MWRA will implement flow management techniques as well as a program to avoid excess pollutant loading. If necessary, future considerations may include flow control structures and satellite treatment plants to minimize peak flows.	Estimates of wastewater flow and pollutant loading have been employed as the basis for wastewater transport, treatment, and outfall project components. Since this commitment will be implemented independently of all alternatives being considered, it is not used as an evaluation criterion. It is the subject of a separate analysis in the facilities plan.
2. Operations and Maintenance	
MWRA is committed to improved operations and maintenance. The facilities plan will initiate early planning of operations and maintenance considerations.	Operations and maintenance considerations are included in evaluation criteria and are pertinent to transport, treatment, and outfall project components.
3. Odor Control	
MWRA is committed to the construction of a facility that will control odors: to eliminate detectable odors offsite, protect the public health, and to to minimize, to the extent feasible, objectionable odors onsite.	Criteria for odors and other air emissions are considered in all project components.

TABLE 4.4.5-2

APPLICABILITY OF COMMITMENTS TO MITIGATION AS EVALUATION CRITERIA
(Continued)

MITIGATION COMMITMENTS	APPLICABILITY OF COMMITMENTS
4. Noise Control	
MWRA has committed to compliance with all legal standards and has set a noise abatement goal that goes beyond simply adhering to applicable codes. MWRA will examine noise abatement throughout the planning, design, construction and operation of the facility to avoid adverse noise impacts. MWRA will also establish an acoustic review board and will solicit community involvement in the noise control program.	Criteria for noise control are considered in all project components.
5. Barging and Busing	
MWRA is committed to the priority of the construction of on-island piers and to limit trucking volume during pier construction; upon completion of pier facilities, to barge almost all heavy construction equipment and materials with a limited level of contingency trucking; to bus all construction workers; and to investigate the practicality of providing ferries to transport construction workers.	Since this commitment will be implemented independently of all alternatives being considered, it is not used as an evaluation criterion. Special transportation needs are included as an evaluation criterion regarding construction support needs.
6. Trucking of Liquid Chlorine	
MWRA has committed to cease the trucking of liquid chlorine through Winthrop immediately after site access facilities and feasible barging become available.	Since this commitment will be implemented independently of all alternatives being considered, it is not used as an evaluation criterion.

TABLE 4.4.5-2

APPLICABILITY OF COMMITMENTS TO MITIGATION AS EVALUATION CRITERIA
(Continued)

MITIGATION COMMITMENTS	APPLICABILITY OF COMMITMENTS
7. Relocation of Deer Island House of Correction	
MWRA has determined that the Deer Island House of Correction must be relocated.	Since this commitment will be implemented independently of all alternatives being considered, it is not applicable for use as an evaluation criterion.
8. Further Measures To Be Examined	
EOEA, in its final certification, recommended that MWRA consider earlier implementation of certain additional measures. Within this facilities plan, MWRA will further examine VOCs and air toxic controls. MWRA will examine other suggestions such as the concept of a "sewer bank," the utilization of satellite plants, additional flow measurements, odor panel formation, odor monitoring, and formation of an acoustic review board.	Air emission control and noise considerations are considered in all project components. Other considerations will be independent of all alternatives being considered and therefore are not used as evaluation criteria.

4.5 GUIDELINES FOR COST EVALUATION

In order to use cost-effectiveness comparisons of the treatment alternatives considered for detailed analysis, these guidelines for unit process cost evaluation and procedures for determining life-cycle costs have been developed based on EPA cost-effectiveness guidelines. Common parameters to be used in all cost effectiveness comparisons include design lives, discount rate, salvage values, and base year for analysis.

Life-cycle cost factors have been prepared for the outfall project, the inter-island conveyance project, the design and construction of the primary treatment facilities, and the design and construction of the secondary treatment facilities due to the phased construction. The derivation of these factors and the common parameters used in the development of these factors are explained in the following paragraphs.

4.5.1 DISCOUNT RATE

At the start of each fiscal year, EPA establishes the discount rate to be used for life-cycle cost analyses. The rate to be used for this analysis is 8-5/8 percent, the rate established by the Water Resources Council as of October 1, 1985.

Several of the events on the life-cycle cost diagram do not occur at one year intervals. Because of this, the life-cycle cost analysis factors generated for the facilities planning have been developed using a monthly discount rate of 0.71875 percent (8-5/8 percent divided by 12), and payments have been divided into monthly periods.

4.5.2 BASE YEAR AND PLANNING PERIOD FOR ANALYSIS

The base month selected for the cost analysis is January, 1990. The year 1990 represents the first year of projected construction activity for primary treatment facilities. Although the projected start-up for construction is not until July of that year, it was considered much easier to use the beginning of the year as a base rather than seven months into the year.

The end of the life cycle of the project will be January, 2020. This provides for 20 years of operation of the completed secondary treatment facilities.

4.5.3 CONSTRUCTION COST INDEX

The construction costs used for based on September, 1986 prices. The Construction Cost Index, as presented in the Engineering News Record (ENR-CCI) for September, 1986, is 4332.5. For simplicity, 4330 was used for the baseline cost index.

4.5.4 COST ESCALATION FACTORS FOR ENERGY USE AND WASTEWATER FLOW INCREASES

There will be no escalation of energy or chemical costs for the purposes of the cost-effectiveness comparisons. Cost escalation for energy and chemicals will be considered as

part of a sensitivity analysis. Different rates will be used to determine potential impacts on total present worth costs of the relative ranks of alternatives. None of the costs will be weighted according to flow. It is unlikely that one alternative would have an appreciably higher flow-dependent cost than another. In addition, the average flow in 1986 is approximately 93 percent of the ultimate average flow. This difference in flow is not enough to warrant a difference in number of staff. And the difference in energy and chemical requirements would not be appreciable.

4.5.5 LIFE EXPECTANCIES

The life expectancies of cost items are important for use in determining future replacement costs and salvage values at the end of the project period. The life expectancies to be used for these projects are as follows: 5 years for vehicles; 15 years for all equipment; and 50 years for buildings, structures, and pipelines.

4.5.6 LAND COSTS

MWRA either owns or is statutorily permitted to use all land on Deer Island. The cost of land is not expected to become a part of the life cycle cost analysis. The land requirements are independent of the treatment process selected since all excess area will serve as a buffer zone. Also, in accordance with the cost effectiveness guidelines, the land values must be salvaged at the end of the planning period and therefore would be negligible in the final cost effectiveness comparison. Therefore, there is no need to consider land costs in the life-cycle cost analysis.

4.5.7 PROJECT COSTS

The term "project cost" is used throughout the discussion of cost factors. This cost consists of the estimated capital construction cost plus the cost of engineering and contingencies. The sum of engineering and contingency costs was estimated to be 35 percent of the installed cost. In other words, the estimated installed cost of an item will be multiplied by a factor of 1.35 to yield the project cost.

4.5.8 INTEREST DURING CONSTRUCTION

Interest during construction was calculated based on the following:

- Uniform cash flow over construction period (therefore, constant gradient of interest payments);
- Discount rate of 8-5/8 percent per year;
- Monthly payments of interest due;
- No investment dividends on borrowed money not yet paid on the project;

- o Gradient series of interest payments converted to annual and then present worth cost.

4.5.9 ANNUAL COST

Annual costs are those costs paid each year to keep the facilities in good operating order and to preserve the lives of structures and equipment. The following items, among others, are included:

- o Wages and salaries;
- o Maintenance items;
- o Energy consumption;
- o Chemicals.

The labor cost for the plant's operation and maintenance staff, including fringe benefits, averages $30,000 per employee per year. The annual maintenance cost which includes lubrication oils, replacement parts, and other maintenance items, is estimated at one percent of the equipment capital costs. The cost of electric power is $0.055/kwh. Chemical costs for the biological treatment alternatives include gaseous hydrochloric acid for cleaning the diffuser discs of the fine bubble diffused air and coupled system alternatives. Chemicals are also required for the disinfection alternatives. For one alternative, sodium hypochlorite must be purchased, while for onsite sodium hypochlorite generation, nitric acid is used for cleaning the generation cells. For the two disinfection alternatives using sodium hypochlorite, dechlorination may be determined necessary. If this is the case, then gaseous sulfur dioxide would have to be purchased. The unit costs for the hydrochloric acid is $65 per ton. The unit cost for the sodium hypochlorite is $0.35 per gallon; $7.10 per gallon for the nitric acid; and $0.15 per pound of sodium dioxide.

4.5.10 BASIS OF COST COMPARISON

All cost comparisons are made in terms of present worth costs instead of equivalent annual costs. This has been done to avoid confusion between equivalent annual costs and annual operating and maintenance costs. Present worth costs provide a convenient method to evaluate one time capital costs and the annual costs of the alternatives on an equivalent basis. Relative rankings of alternatives will not change whether present worth or equivalent annual cost is the method of comparison.

Table 4.5.10-1 has been prepared with both 1990 and the start-up date of the individual item as base years. Present worth factors at the start-up date have been prepared because in the case of secondary treatment, translating future costs to present worth makes them appear deceptively low.

TABLE 4.5.10-1

SUMMARY OF LIFE-CYCLE COST FACTORS

Item	Factor For Present Worth at Base Year-January 1990
Effluent Outfall Project	0.77 Cout +6.99 Aout
Inter-Island Conveyance System	0.76 Ctun +6.66 Atun
Primary Treatment Facilities Project	0.94 Cpe +0.76 Cps +2.01 Cpv +6.35 Ap
Secondary Treatment Facilities Project	0.61 Cse +0.50 Css +1.03 Csv +4.03 As

Notes:

1. Final Project Month = January, 2020
2. Discount Rate = 0.71875% per month (based on 8-5/8% per year)
3. Abbreviations
   - Cout - Project Cost of Outfall
   - Aout - Annual Maintenance Cost for Outfall
   - Ctun - Project Cost of Inter-Island Conveyance System
   - Atun - Annual Maintenance Cost For Inter-Island Conveyance System
   - Cpe - Project Cost of Primary Treatment Equipment
   - Cps - Project Cost of Primary Treatment Buildings Structures, and Pipelines
   - Cpv - Project Cost of Primary Treatment Vehicles
   - Cse - Project Cost of Secondary Treatment Equipment
   - Css - Project Cost of Secondary Treatment Buildings, Structures, Pipelines
   - Csv - Project Cost of Secondary Treatment Vehicles
   - Ap - Annual Operations and Maintenance Cost for Primary Treatment
   - As - Annual Operations and Maintenance Cost for Secondary Treatment
4. Life Expectancies

Equipment	15 Years
Buildings, Structures, Pipelines	50 Years
Vehicles	5 Years

5.0 EXISTING CONDITIONS

This section has three main parts: a description of the MWRA wastewater collection and treatment system; a description of the existing environment; and a description of historical and archaeological resources.

5.1 WASTEWATER COLLECTION AND TREATMENT SYSTEM

This section presents a description of the current wastewater collection and treatment facilities and the on-going program to upgrade the existing Deer Island Wastewater Treatment Plant and the existing headworks on the North Metropolitan Sewer System. Solids-handling-related facilities are the subject of a separate facilities plan and are not specifically addressed as part of this description. The ongoing rehabilitation program, called Fast-Track Improvements, is intended to provide reliable treatment until existing facilities are replaced or improved during construction of the new treatment facilities.

5.1.1 WASTEWATER COLLECTION SYSTEM

The MWRA's wastewater collection system consists of a North System and a South System. North System flows are collected and transported to the Deer Island Treatment Plant. South System flows are collected and transported to the Nut Island Treatment Plant.

North System

Influent flow enters the Deer Island plant through both the Main Pumping Station and the Winthrop Terminal Headworks.

The Main Pumping Station at Deer Island can pump from either of two deep rock tunnels, each constructed 300 feet below sea level. The first tunnel, the Boston Main Drainage Tunnel, is approximately 7 miles long. It crosses under Boston Harbor from Deer Island to South Boston where it connects to the Columbus Park Headworks. The Boston Main Drainage Tunnel continues from Columbus Park to the Ward Street Headworks located off of Huntington Avenue, near the Wentworth Institute of Technology. The second rock tunnel, the North Metropolitan Relief Tunnel, is approximately 4 miles long. In connects the Chelsea Creek Headworks to the Main Pumping Station at Deer Island. The Main Pumping Station has no wet well and the two tunnels are not connected. Each pump can draw from either tunnel, and the suction connection to each tunnel is controlled by air operated butterfly valves.

The Winthrop Terminal Headworks screens and pumps influent flow that arrives at Deer Island via the North Metropolitan Trunk Sewer. This sewer is the original interceptor to Deer Island and is roughly paralleled by the North Metropolitan Relief Tunnel. The North Metropolitan Trunk Sewer receives flows from Winthrop, Orient Heights, and Deer Island, and overflows from the Chelsea Creek Headworks via the East Boston Pumping Station. The North Metropolitan Trunk Sewer has a peak capacity of 125 mgd. The Winthrop Terminal was designed to screen this entire flow and to provide grit removal for 60 mgd. Flows receiving grit removal are

discharged to the primary plant. Flows in excess of the capacity of the grit system are discharged directly to the Deer Island Plant bypass.

The North System components are shown schematically in Figure 5.1.1-1. During peak flows, normally caused by wet weather flows from the numerous combined sewers of the North Metropolitan System, the Boston Main Drainage and North Metropolitan Relief Tunnels are selectively throttled at the three remote headworks, thereby diverting flows in excess of the plant's capacity to combined sewer overflows.

When the Ward Street Headworks is throttled, the majority of excess flow is diverted to the Cottage Farm Chlorination Facility which discharges to the Charles River.

When the Columbus Park Headworks is throttled, the majority of excess flow is diverted to the Calf Pasture Pump Station, located at Columbia Point, which pumps the wastewater to the Moon Island Outlet which discharges to Dorchester/Quincy Bay.

At Chelsea Creek, excess flow is diverted, via a siphon, across the creek to the East Boston Pump Station and is pumped from there into the North Metropolitan Trunk Sewer.

The North System is operated to maximize the flow from both the Chelsea Creek Headworks and the inter-connected Winthrop Terminal Headworks/East Boston Pump Station System. Because flow from Chelsea Creek Headworks is optimized, the system initially throttles flow at the Ward Street Headworks and, if necessary, at the Columbus Park Headworks.

The hydraulic capacities of the existing major conveyance facilities in the North and South Systems are presented in Table 5.1.1-1.

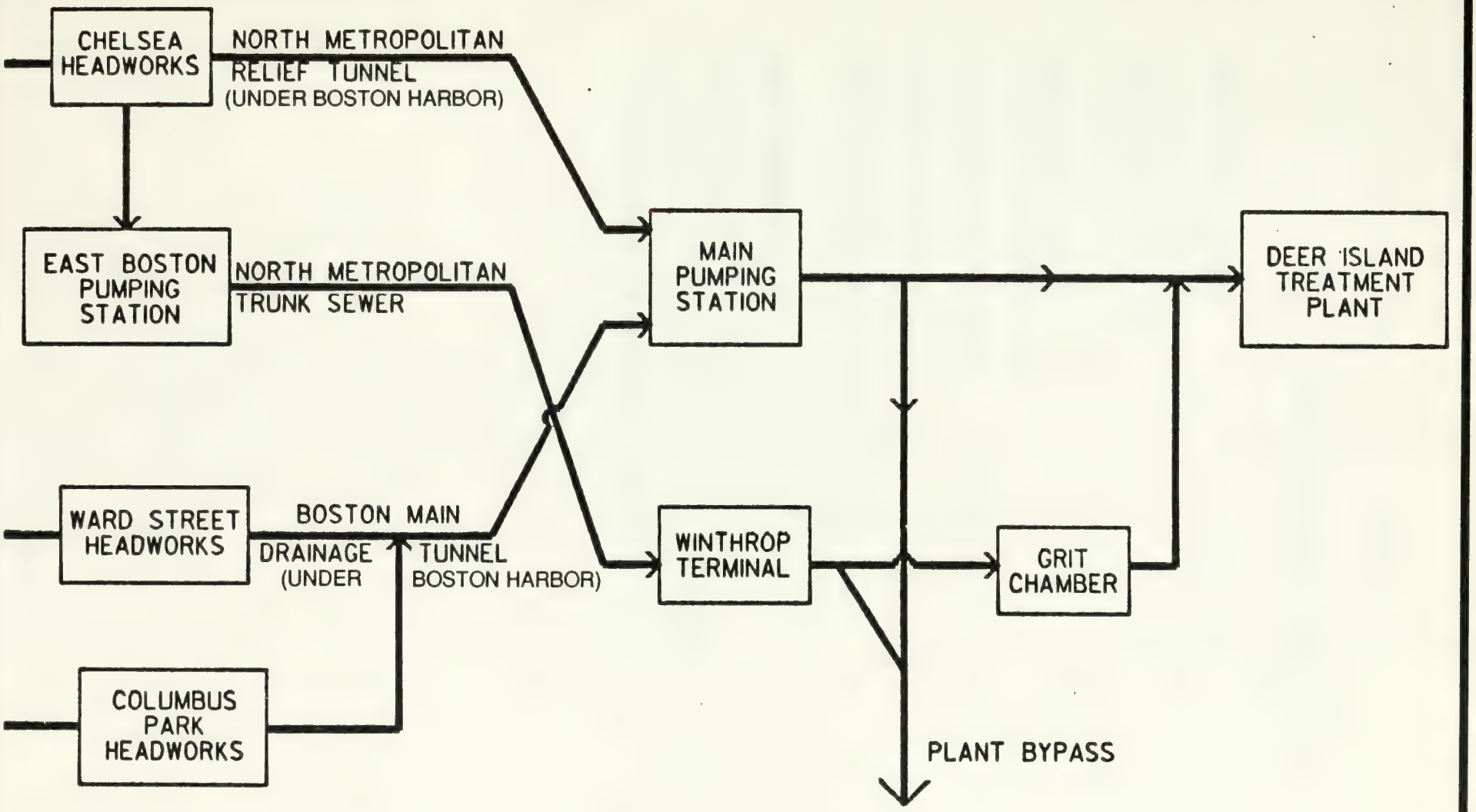
South System

The South Metropolitan Sewerage System's High Level Sewer conveys wastewater to the Nut Island Treatment Plant in Quincy. There are no remote headworks on the South Metropolitan Sewerage System. The High Level Sewer is fed by various upstream interceptors and force mains.

The South Metropolitan Sewerage System consists of a network of approximately 78 miles of MWRA interceptor sewers, five pump stations which are owned and maintained by the MWRA, and the existing Nut Island treatment plant.

The High Level Sewer (HLS), begins in the Parker Hill section of Roxbury, just south of the North Metropolitan System's Ward Street Headworks. The HLS's length is about 15 miles and extends through Hyde Park, Milton, and Quincy to the Nut Island Plant. Along the sewer route, major flows are received from MWRA extension sewers, including the Brighton Branch, Neponset Valley Sewer, Upper Neponset Valley Sewer, New Neponset Valley Sewer, Wellesley Extension Sewer, and the Wellesley Extension Relief Sewer.

Influent flows are also received from the Merrymount, Squantum, Braintree-Weymouth, and Houghs



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 5.1.1-1 NORTH SYSTEM HEADWORKS AND TUNNEL SCHEMATIC

TABLE 5.1.1-1

HYDRAULIC CAPACITY OF MAJOR NORTH AND SOUTH METROPOLITAN CONVEYANCE FACILITIES

North Metropolitan System	Size of Line	Peak Capacity (mgd)
Boston Main Drainage Tunnel Deer Island P.S. to Columbus Park Segment	11 ft - 6 in	438
Boston Main Drainage Tunnel Columbus Park to Ward St. Segment	10 ft	256
North Metropolitan Relief Tunnel	10 ft	350
North Metropolitan Trunk Sewer	108 in	125
Total Capacity to Deer Island		913
South Metropolitan System		
High Level Sewer	11 ft - 3 in x 12 ft - 6 in (maximum)	360*

*Unsurcharge capacity with free discharge at Nut Island.

Neck pumping stations. The cross sectional size of the sewer ranges from 8 feet-3 inches by 9 feet-6 inches in the upstream reaches, to 11 feet-3 inches by 12 feet-6 inches at the entrance to the treatment plant. The average slope is approximately 1 foot per 3,370 feet, with the invert of the sewer dropping a total of 24 feet from Parker Hill to the plant. The HLS was generally constructed of either brick or concrete in the excavated sections, and was tunneled in some sections, depending on the depth and soil conditions. The capacity of the High Level Sewer was taken to be 310 mgd from the Site Options Study. Future capacity has been evaluated based on recent modeling and flow measurements and established at 360 mgd with free discharge at Nut Island.

Main components of the South Metropolitan System are shown schematically in Figure 5.1.1-2.

5.1.2 NORTH SYSTEM HEADWORKS FACILITIES

The North System includes four headworks facilities at Chelsea Creek, Ward Street, Columbus Park and the Winthrop Terminal which are described below.

Chelsea Creek Headworks

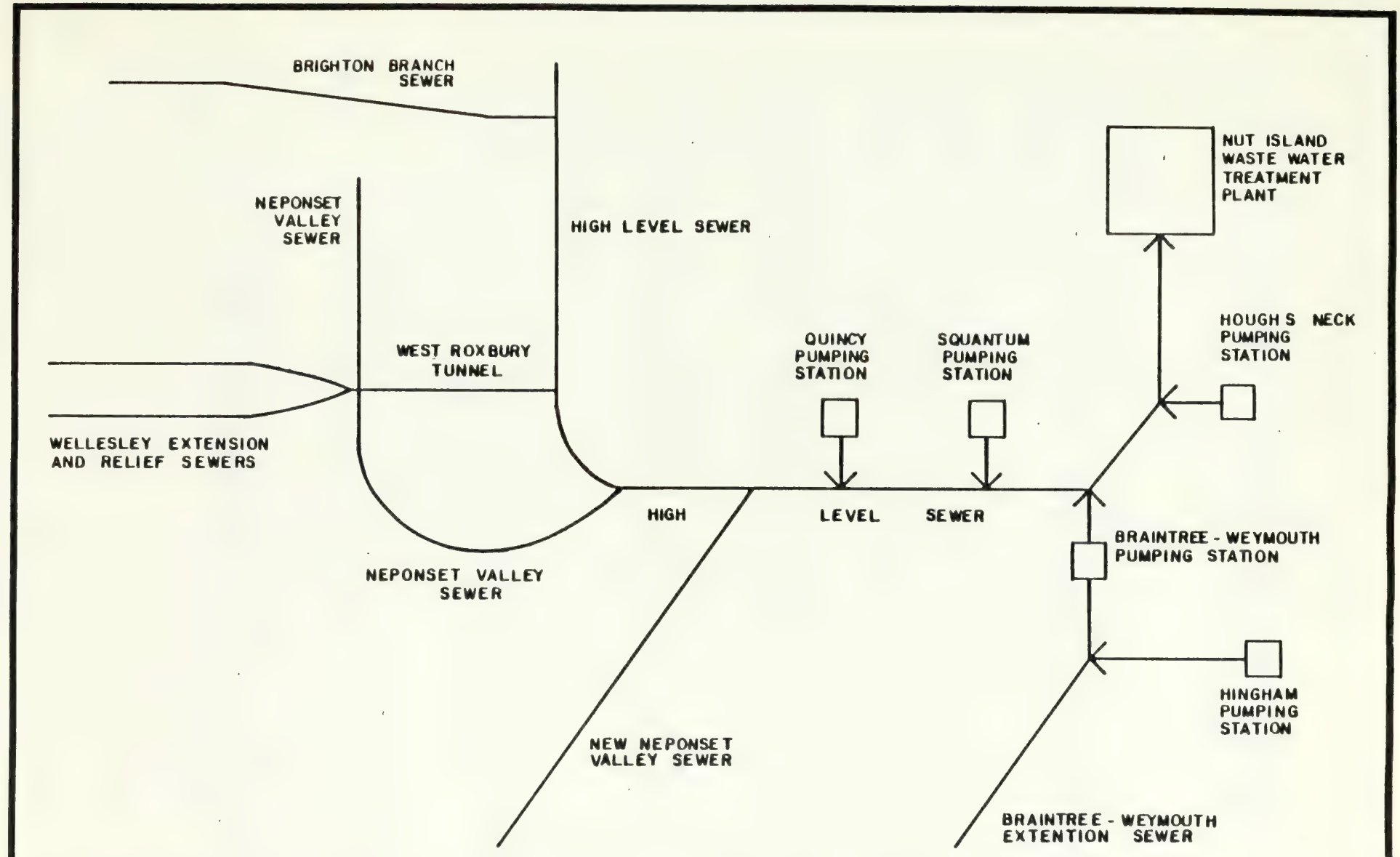
The Chelsea Creek Headworks was placed in operation in 1968 to provide preliminary treatment, consisting of screening and grit removal, to a portion of the flow being treated at the Deer Island Wastewater Treatment Plant.

Wastewater flows through this facility by gravity and is discharged to the North Metropolitan Relief tunnel through the 10-foot-diameter vertical shaft No. 2 which extends approximately 300 feet below grade. The 10-foot-diameter North Metropolitan Relief Tunnel, 20,800 feet long, conveys the wastewater under Boston Harbor to Shaft No. 1 and the Main Pumping Station intake at the Deer Island Treatment Plant.

The headworks' superstructure is constructed of brick, block, and metal siding. The concrete headworks also have a substructure that extends approximately 40 feet below grade and contains four parallel treatment channels. Each channel at this headworks, as well as at the other existing remote headworks, is provided with the following equipment:

- Inlet and outlet sluice gates;
- Mechanically cleaned fine screens;
- Mechanically cleaned grit settling basins;
- Parshall flume for velocity control and for flow measurement.

Each treatment channel is rated at 117 mgd peak capacity. The headworks capacity of 350 mgd allows for one treatment channel to be held in reserve. Pneumatic ejectors transport the screening and grit to above-ground storage hoppers. Periodically, this material is discharged to trucks for disposal.



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 5.1.1-2
SOUTH COLLECTION SYSTEM SCHEMATIC

Fast-track improvements will include installation of new climber-type mechanically-cleaned screens, and grit collection equipment, as well as screening and grit handling and transport equipment.

Ward Street Headworks

The Ward Street Headworks is similar in most respects to the Chelsea Creek and Columbus Park facilities. This remote headworks, located in Roxbury Crossing, has been in operation since 1968, provides preliminary treatment consisting of screening and grit removal, to the wastewater.

Flow through the Ward Street facility is by gravity. Effluent is discharged to a 10-ft-diameter vertical Shaft A, which extends some 300 feet below grade to the Boston Main Drainage tunnel. The Main Drainage Tunnel begins at the base of Shaft A, runs approximately 13,700 feet to Shaft B which serves the Columbus Park headworks, and then proceeds 23,800 feet under Boston Harbor to Shaft C at the Deer Island Treatment Plant Main Pumping Station.

The Ward Street Headworks consists of a brick and block multi-level superstructure and a reinforced concrete substructure which extends approximately 40 feet below grade. Within the substructure are four 85.3 mgd capacity channels, any three of which provide the rated capacity of 256 mgd.

Pneumatic ejectors transport the screenings and grit to above-ground storage hoppers. Periodically, this material is discharged to trucks for disposal. Fast-track improvements will be the same as those described for Chelsea Creek.

Columbus Park Headworks

Except for size and processing capacity the Columbus Park Headworks is similar in most respects to the other remote headworks. This facility, located in South Boston, went into operation in 1968 to provide preliminary treatment consisting of screening and grit removal, to the wastewater prior to discharge to the Main Drainage Tunnel.

Flow through the headworks is by gravity. Effluent is discharged to vertical Shaft B, which extends approximately 300 feet below ground to the Boston Main Drainage Tunnel. The upstream segment of the tunnel is 10 ft in diameter and the downstream segment in 11 ft - 6 inches in diameter.

The headworks consists of a brick, block, and precast concrete multi-level superstructure and a reinforced concrete substructure extending approximately 30 feet below grade. Within the substructure are four treatment channels. Each channel is rated at 61 mgd and the headworks is rated at 182 mgd.

Pneumatic ejectors transport the screening and grit to above-ground storage hoppers. Periodically, this material is discharged to trucks for disposal.

Fast-track improvements are the same as those described for other headworks.

Winthrop Terminal

The Winthrop Terminal facility, located at the Deer Island Treatment Plant, is situated between the existing administrative building and the primary clarifiers. The facility houses pumping equipment for flows arriving at Deer Island via the North Metropolitan Trunk Sewer and headworks facilities that provide preliminary treatment consisting of screening and grit removal. The North Metropolitan Trunk Sewer has a peak capacity of 125 mgd. The Winthrop Terminal was designed to screen and pump this entire flow and to provide grit removal for up to 60 mgd. Flows receiving grit removal are mixed with discharge from the Deer Island Main Pumping Station for treatment at the Deer Island Treatment Plant. Flows in excess of the capacity of the grit system are pumped directly to the Deer Island bypass for discharge to the plant outfall system.

Blowers, which provide air to the influent channels of the Deer Island primary sedimentation tanks, are housed within the Winthrop Terminal building.

Influent flow to the facility is split to three screening channels. Normally, one channel is in service at a time. During wet-weather, high-flow events, all three channels are put into operation.

Screened wastewater flows by gravity to two wet wells. The wells are interconnected by a remote-controlled sluice gate. The middle screening channel has the capability of discharging to either wet well. From the wet wells, a bank of six centrifugal pumps lift wastewater to the effluent channel. Four of the pumps are electric motor-driven and are rated at 15 mgd each. The two remaining pumps are diesel engine-driven and are rated at 30 to 60 mgd each, depending upon whether they are discharging to the effluent channel or the Deer Island Plant bypass line. From the effluent channel, flow passes through a parshall flume to two aerated grit chambers. The maximum flow capacity of the grit chambers is 30 mgd each. Effluent from the aerated grit tanks discharges to a 54 in pipe. This flow is then mixed with the discharge from the Deer Island Main Pumping Station and enters the primary sedimentation tanks.

MWRA's recommended fast-track improvements include replacement of existing coarse and medium bar screens with 7/8-in-spaced climber-type bar screens, overhaul of electric pump motors, refit of pump impellers, construction of a grit bypass system, new instrumentation and controls, hvac and odor control equipment. The existing bypass will be replaced by the construction of a 4-ft by 4-ft conduit between the pump station discharge flume and the deer island main pumping station effluent conduit.

The bar screens were sized for two screens to handle the 125 mgd flow, and the third screen is to be either held in reserve or out of service. After the fast-track improvements, the Winthrop Terminal Pumping Station will have the following capacity:

No. Pumps	Pump Rated Capacity mgd
2	37
4	22

In order to handle the 125 mgd design flow, at least five of the six pumps will have to be in operation, with only one pump on standby.

5.1.3 DEER ISLAND TREATMENT PLANT

The Deer Island Wastewater Treatment Plant, originally completed in 1968, provides primary treatment to flows from the North Metropolitan Sewerage System. The plant was designed to treat an average flow of 343 mgd and a peak flow of 848 mgd. Treatment consists of preaeration, primary sedimentation, and disinfection.

Flows from the Boston Main Drainage and North Metropolitan Relief tunnels are pumped to the treatment plant at the Deer Island Main Pumping Station. Flows from the North Metropolitan trunk sewer are discharged to the plant via the Winthrop Terminal. Mixed flows are discharged to two preaeration channels. Primary treatment is provided by eight sedimentation tanks. effluent from the primary tanks is chlorinated and discharged to the Harbor through a series of outfalls.

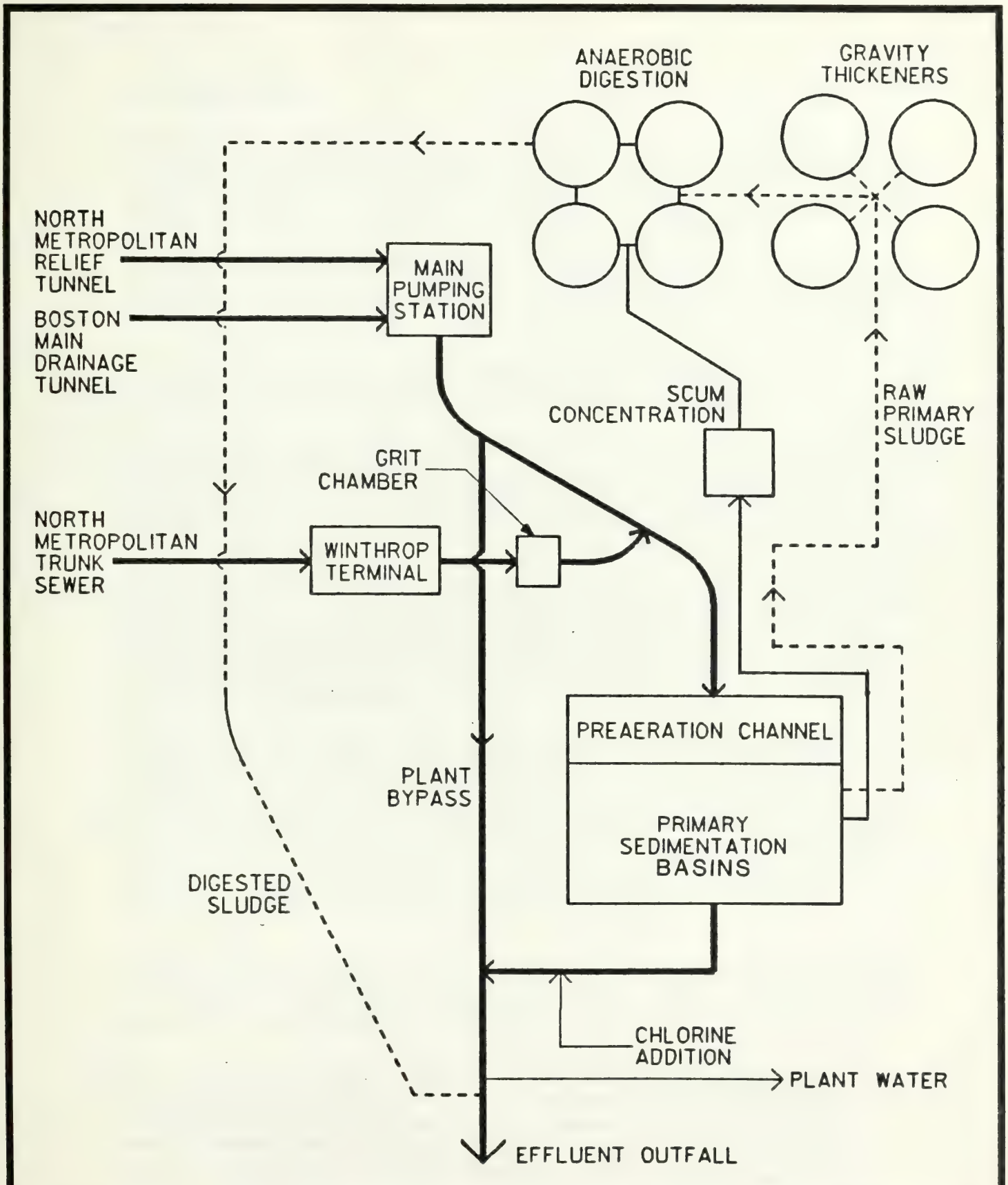
Primary sludge, grease, and scum is collected, thickened, and pumped to anaerobic digesters. Digested sludge, and bypass flows from the Winthrop Terminal are mixed with the primary effluent prior to discharge to the Harbor.

Major Components

The major components of the original Deer Island Wastewater Treatment Plant include the following:

- Nine main sewage pumps, 90 mgd each
- Two preaeration channels, 400 ft x 20 ft
- Eight primary sedimentation tanks, 245 ft x 100 ft
- Four raw sludge pumping stations with three pumps in each
- Four anaerobic digester tanks
- Five diesel generating sets, 700 kw each
- Five chlorinators, 8,000 lb/day each
- Five outfalls to the Harbor

Schematics of the Deer Island Wastewater Treatment plant showing the flow pattern, the number and arrangement of treatment units, and the outfall system are shown in Figure 5.1.3-1.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 5.1.3-1 DEER ISLAND WASTEWATER TREATMENT PLANT SCHEMATIC - EXISTING CONDITIONS

Main Pumping Station

The Deer Island Treatment Plant Main Pumping Station consists of nine vertical shaft, mixed-flow, bottom-suction sewage pumps. Each pump is rated for 90 mgd at 105 ft total dynamic head (tdh) and 400 rpm. The pumps were designed to be operated over a speed range of 250 to 400 rpm. An empty bay is provided in the pumphouse for a tenth pump.

The pumps are driven through 90-ft-long shafts. Eight pumps are driven by diesel engines, and one pump is driven by a 2,000 hp synchronous electric motor with a variable speed magnetic coupling.

The diesels are 12 cylinder, radial type, vertical shaft engines furnished by the Nordberg manufacturing Company of Milwaukee, Wisconsin, and St. Louis, Missouri.

Each pump suction piping connects to a bifurcation,which is piped to both the Boston Main Drainage and North Metropolitan Relief Tunnels. Each leg of the bifurcation contains a 60-in-diameter butterfly valve and a 60-in-diameter rubber expansion joint. The butterfly valves are pneumatically operated with a manual handwheel override. There are no valves on the pump discharge.

The pumps lift the wastewater through a 60-in-diameter pipe discharge which includes a venturi meter to measure flow. Each pump discharge line is arranged as a siphon and each siphon is equipped with vacuum-priming and vacuum-breaking piping and valves. Two vacuum pumps are provided to prime the nine siphons. The pumps discharge to one of two headers which join in a common conduit to the primary plant.

The Deer Island Main Pumping Station receives wastewater from the three remote headworks and lifts it to the head end of the treatment plant. The pumping rate is adjusted to maintain a constant water level at the headworks. Pump startup and shutdown, and butterfly valve opening and closing, are done at the Main Pumping Station control room. Adjustment of pump speed is done either manually at the pump driver or automatically in the control room. Pump suction valving is such that any pump may take suction from either tunnel. The original nickel-iron alloy impellers have been replaced. Seven impellers are now stainless steel and two are nickel-iron alloy.

The pump drivers are arranged in two rows (odd numbers to the west, even numbers to the east) at floor elevation 130 ft, the operating floor of the Main Pumping Station. The original plant design includes space allocation for a future pump (No. 10).

Based on discussions with plant operators and a review of the Deer Island Facilities Plan - Volume 1 Fast-Track Improvements document, the unreliability and high maintenance associated with the Nordberg diesels constitute the most serious problem in the operation of the pump station/powerhouse facilities. These particular engines have been out of production since 1965, and Nordberg Mfg. Co. is no longer in business. Because of this, the costs of replacement parts is extremely expensive and some parts are virtually unobtainable.

The proposed fast-track improvements to the Deer Island Main Pumping Station include the following:

- o Empty bay (No. 10) and pump bays (No. 2, 4, 6, and 8) provide:
  - Five new vertical centrifugal pumps, each rated 90 mgd at 105 ft tdh.
  - Four new 2,000 hp synchronous motors, variable speed magnetic coupling drives, and reduced voltage starters. One existing 2,000 hp electric motor and variable speed drive (No. 8) will remain in service.
  - One new 8-in-diameter solid steel shaft, bearings and couplings (No. 10).
- o Four existing shafts (No. 2, 4, 6, and 8) are proposed to remain in service and be modified to accept new 2,000 hp motors. Condition of existing shafts will be verified by non-destructive testing. Existing bearings will be evaluated and replaced as required. Method of lubricating bearings will be improved. New spacer couplings will be provided to facilitate pump maintenance.
- o Existing and new electric-driven pumps will be controlled from a new pump control room to be located on the mezzanine level. New 4,160 V motor starters and variable speed drive controllers will be installed in a new electrical room also located at the mezzanine level.
- o Five existing Nordberg engines, shafts and pumps (no. 1, 3, 5, 7, and 9) will remain in service. These pumps will continue to be controlled pneumatically from a local panel at each engine. Remote auto-manual, speed, status and alarm conditions will be relocated to a new pump control room by installing P/I converters at the existing graphic panel and transmitting electronic signals to the new control room. The existing control room will be abandoned.
- o The existing pneumatic analog pump controller will be replaced with a new electronic analog controller (microprocessor) to accommodate the new electric motor-driven pumps and the new electronic signals from the existing Nordberg engine driven pumps.
- o The pump suction piping for the five electric motor driven pumps (No. 2, 4, 6, 8, and 10) will be revised to include a new 60-in knife gate valve downstream from each butterfly valve (one valve on each leg of the wye). They will be installed

without dewatering the tunnel system and will protect the pump station against butterfly valve failure in the open position.

- A new 60-in butterfly valve will be installed in the existing discharge piping of pump No. 2, 4, 6, and 8.

- New 60-in steel discharge piping, flow meter and butterfly valve will be installed for the new pump No. 10 (empty bay).

- The new discharge valves will allow the pumps to be started against a closed discharge valve instead of a closed suction valve, eliminating the cavitation condition that occurs at present. The new discharge valve will be closed just prior to normal shutdown of the pump.

Power And Utilities

The power station generating capability currently consists of five diesel generator sets provided by the Enterprise Engine & Machinery Company of Oakland, CA, which were installed with the original plant in 1968. The diesels are eight cylinder, in-line type engines that can be operated on digester gas or diesel fuel. The generators are rated at 700 kw each and were furnished by Allis Chalmers.

The five diesel generators are arranged side by side and numbered sequentially from north to south, at the operating floor level (elevation 130 ft). The diesel engines are reliable and have good availability.

The proposed fast-track improvements to the generating facilities include the following:

- The five existing 700 kw diesels will be rehabilitated (under Power Distribution Rehab Contract) and will remain in service.

- Install two new 6,000 kw dual fuel diesel engine/generator sets in a new building addition. New diesel engines will be started/ stopped locally at each diesel and controlled from a new control panel in the switchgear room. Alarm and status indicators will be located at diesels, in the switch-gear room, and in the new Pump Control Room.

- A new power distribution arrangement will allow the diesels to operate in parallel or be separated (5 existing diesels on one bus and 2 new diesels on another bus). In general, the two new diesels will power the electric-driven raw sewage pumps and the existing diesels will power all other plant loads.

- The existing once-through cooling water will be replaced with a closed loop water system with heat rejection through cooling towers. The new system will recover heat from the jacket water of the Enterprise engines, the new 6,000 kw engines and the remaining Nordberg engines. The heated closed loop water will be routed through heat exchangers to provide heat to the sludge heating water, which in turn will be routed through heat exchangers to heat sludge at the digesters.

Treatment Facilities

Flows from the Main Pumping Station and the Winthrop Terminal are discharged to two preaeration channels which also serve as distribution channels to the eight primary sedimentation tanks.

Wastewater is conveyed from the Main Pumping Station and Winthrop Terminal to the primaries via a 20-ft-wide by 14-ft-deep concrete channel which flows full. This channel splits into two 10-ft-wide by 14-ft-deep aerated channels, each of which feeds one-half of the primary tanks. Either of these channels can be isolated from the main influent channel by means of large motor-operated sluice gates.

The two aerated channels are furnished with one stationary air diffuser and 22 swing arm diffusers each. Positive displacement compressors for these diffusers are located in the Winthrop Terminal Headworks.

From the aerated channels, wastewater is fed into each primary sedimentation tank through ten manually operated 24-inch by 42-inch downward operating sluice gates. Each primary sedimentation tank is approximately 100 ft wide by 240 ft long with an average side water depth of 11.35 ft. The tanks are equipped with traveling bridge collectors and chain and flight cross-collectors. Each tank has approximately 100 ft of straight-edge weir at its effluent end over which settled wastewater falls into the effluent channel.

Traveling bridge collectors push scum to the effluent end of the tanks, where the bridge pauses for a period of time while a reciprocating scum collector travels back and forth across the width of the tank and pushes scum over a V-notch weir on either side of the tank. Scum from all eight tanks flows to a central sump located between Tank Nos. 4 and 5 from where it is pumped to scum thickeners. Sludge is pushed to the influent end of the primary tanks to the cross-collector hopper where it is moved to one end by a chain and flight collector. Sludge is withdrawn from the hopper by sludge pumps, three of which are provided for each pair of primary tanks.

The westernmost aerated influent channel of the settling tanks has substantial accumulations of grit, nearly reaching the water surface at the downstream end at the time of the on-site inspections during August and September, 1986. This may be caused by the poor condition of the swing diffusers which have never been replaced, higher concentrations of grit to the westernmost channels due to hydraulic anomalies, lack of sufficient mixing air, poor upstream grit removal, or all of the above.

The swing diffusers are in poor condition. Those in the easternmost channel were replaced several years ago and are operable but have serious corrosion problems, with holes completely through the pipe in some places. Those in the westernmost channel are original equipment, and are in very poor condition. These diffusers create little visible turbulence and are covered with grit. Plug valves for the diffusers are rusted and some are stuck in the open position.

The inlet sluice gates and inflet baffles to the primary tanks are in poor condition. The sluice gates are opened and closed manually or by portable electric operators. The portable operator sometimes causes the gates to be opened or closed too far, creating high stresses on the gate itself or on the anchoring system. Half of the 80 gates show evidence of these problems. Five gates cannot be fully closed, making dewatering difficult. Maintenance of the sluice gates is hampered by their location on the aeration channel side of the wall (seating head). This means that for adjustments to be made on any one gate, one-half of the plant's primary treatment capacity must be removed from service. Each sluice gate has a steel inlet baffle just downstream on it, inside the tank. These baffles are severely corroded and some are completely missing.

Dewatered basins have reportedly experienced leakage through several expansion joints from full basins into emptied basins. It is not known at this time how many of the basins are affected or to what degree of severity the leakages occur.

The water level in the effluent channel from the primary tanks was originally maintained by a tainter gate in order to provide chlorine contact time. A few years after start of operation, this gate became inoperable. As a result, the water level in the channel is now below the elevation of the scum sump float valve and it is inoperable.

Currently, one scum pump is continuously operating with the scum collection V-notches set to match this flow as closely as possible. However, the pump normally pumps slightly more than this, and lowers the water level in the sump until the pump begins taking air.

The scum collection system has proven to be a problem, particularly in winter months. Scum begins freezing at the V-notch weirs and if not broken up and manually pushed over the weir, the buildup begins extending out into the tank. This situation is difficult to overcome because the scum-collecting mechanism must be started manually and thus does not clean the surface every time the traveling bridge delivers a load of scum. Further, the remote and exposed location of the scum collectors does not encourage manual attention, particularly during severe weather when attention is most required. In the past, this problem has often proven disastrous, bending scum collectors on the traveling bridges and sometimes becoming so severe that tanks have had to be removed from service.

The following problems have been reported with the operation of the sludge pumping station:

1. All of the Homestead crossover valves on the primary sludge pump intakes are frozen in either open or shut positions. Consequently, the middle pump at each station is available as standby for only one of the two tanks.

2. All of the sump pumps at the primary sludge pumping stations have either been removed or are inoperable. None of the pumps has worked for about 10 years. As a result, the crossover valves are usually submerged.

3. There are no check valves on the primary sludge pump discharge pipe.

4. The water seal glands and piping are corroded and in poor condition for all 12 primary sludge pumps.

5. For most of the primary sludge pumps, the coupling guard protection is gone.

6. Most of the primary sludge pump pressure gauges are rusted out, and none works.

The electrical power system and controls for many of the traveling bridge collectors are in poor condition. Much of the electrical conduit is badly rusted and most of the timers for short-and medium-pass bridge travel modes are inoperable or removed. Some chain and sprocket guards for the traveling bridges are badly rusted.

Turnbuckles and cables used for raising and lowering the sludge and scum collector blades are a constant problem because of corrosion and breaking. Cable and turnbuckles often break. When this occurs, the sludge scraper falls to the bottom of the tank and often becomes bent.

Originally, the traveling bridges were supplied power by bus bar. This caused severe problems during cold or wet weather, and the system was replaced with festooned cable. The cable has proven fairly reliable, except that occasionally a cable ring breaks and drops the cable to the rail where it is cut by the bridge wheel, putting the unit out of service.

The proposed Fast-Track Improvements Program at the Deer Island Primary Treatment Facilities includes the following components:

- Replacement of all 80 influent sluice gates and baffles to the primary tanks;

- Replacement of the sludge collectors and travelling bridge drives and hoists;

- Rehabilitation of the traveling bridges;

- Installation of new scum collection and pumping systems.

Disinfection is currently provided to the plant effluent using gaseous chlorine. Chlorine can also be used for pre-chlorination just prior to the flow's entering the primary tank preaeration channels; for pre-chlorination of influent flows to the Winthrop Terminal Headworks; and for disinfection of non-potable plant water.

Chlorine is delivered to the Deer Island Plant in 16-ton tanker trucks which are stored in the

chlorine storage room. Each chlorine tanker truck is located on a separate weigh scale. Chlorine is withdrawn from the tankers and piped to a separate chlorine feed room which houses seven evaporators and seven chlorinators. Injectors are operated by non-potable plant process water and booster pumps. The injectors pull chlorine from the chlorinators under vacuum and inject it at the various application points.

The existing chlorination system is at the end of its useful life. The MWRA has determined that sodium hypochlorite, rather than gaseous chlorine will be used for disinfection. The MWRA is currently in the process of designing the sodium hypochlorite system.

The Deer Island Fast-Track Improvements Program is proceeding, making those improvements to the existing gaseous system necessary for plant safety.

Outfalls

There are five outfalls from Deer Island, designated by the EPA as 001 through 005. Construction dates back to the 1890s, with the newest outfall having been constructed in 1964.

Outfall 002 is the oldest, and was constructed in three phases. The first phase was built in 1891. This consists of the portion on Deer Island, a 63-1/2 in by 60-in wide, egg-shaped, brick-lined, concrete tunnel leading to a shoreline outlet. In 1895 the second phase was built. This extended the outfall about one quarter of a mile offshore in a southerly direction, into President Roads channel. Approximately one third of the length of the conduit installed in this phase consists of 63-1/2-in-diameter brick-lined tunnel formed in concrete. The remainder is a 63-1/2-in-diameter pipe built up from wood stave, with a brick lining set in Portland cement. The pipe is anchored to pile bents, buried, and protected with rip-rap. The outlet is an upturn which is flush with the harbor bottom.

The third and final phase of Outfall 002 was installed in 1917. It consists of an approximately 300-ft extension of 60-in-diameter cast iron pipe. The first 200 ft are buried and protected with rip-rap. A partially buried diffuser makes up the last 100 ft. Thirteen elliptically-shaped ports were cast into the top of the iron pipe, and the end has a 48-in-diameter opening. When this extension was installed, the vertical outlet of the previous 1895 phase was capped off.

Outfall 003 was originally constructed as a bypass to be used during the installation of the diffuser, or third phase, extension of Outfall 002. It is approximately 1200 ft long. About half of this outfall is on the island and consists of 78-in-diameter formed-in-place concrete pipe. The offshore portion extends southeast to a vertical outlet about one-tenth of a mile from the island. It is constructed of 60-in-diameter cast iron pipe buried and protected with rip-rap. The outlet is flush with the harbor bottom.

Outfall 001 was installed in 1964 as a part of the primary treatment plant project constructed on the island for the North Metropolitan Sewerage System. It consists of a buried 120-in-diameter reinforced concrete pipe protected with rip-rap. The outfall extends about one-half

mile offshore to the south-southeast into President Roads channel. It terminates in a diffuser approximately 250 ft long.

The diffuser nozzles are 20-in-diameter and are arranged in pairs angled at 45° to the vertical. The pairs are spaced on 8-ft centers over the length of the diffuser, which steps down in size from 120-in-diameter to 108-in-diameter to 60-in-diameter. A short endpiece consists of three staggered nozzles with a 30-in-diameter upturned opening at the end. There are a total of 58 nozzle ports. The diffuser section is buried up to the nozzles and protected with rip-rap.

Outfalls 004 and 005 are relief bypasses installed for use during the construction of Outfall 001. They consist of buried, 108-in-diameter reinforced concrete pipe. Outfall 004 extends offshore a few hundred feet from its connection to the pipe leading to Outfall 001, in a southerly direction. The outlet is simply the open end of the pipe. The area over the pipe and around the outlet is protected with rip-rap. Outfall 005 has a shoreline outlet connecting to the pipe leading to Outfall 001, upstream of Outfall 004. It discharges on the west shore of the island a few hundred feet north of Outfall 004. The outlet is similar to that of 004. Outfalls 003 and 004 are currently used when the capacity of Outfalls 001 and 002 is exceeded. Outfall 005 is not used for excess flow, but only if repair work is being done on the other outfalls.

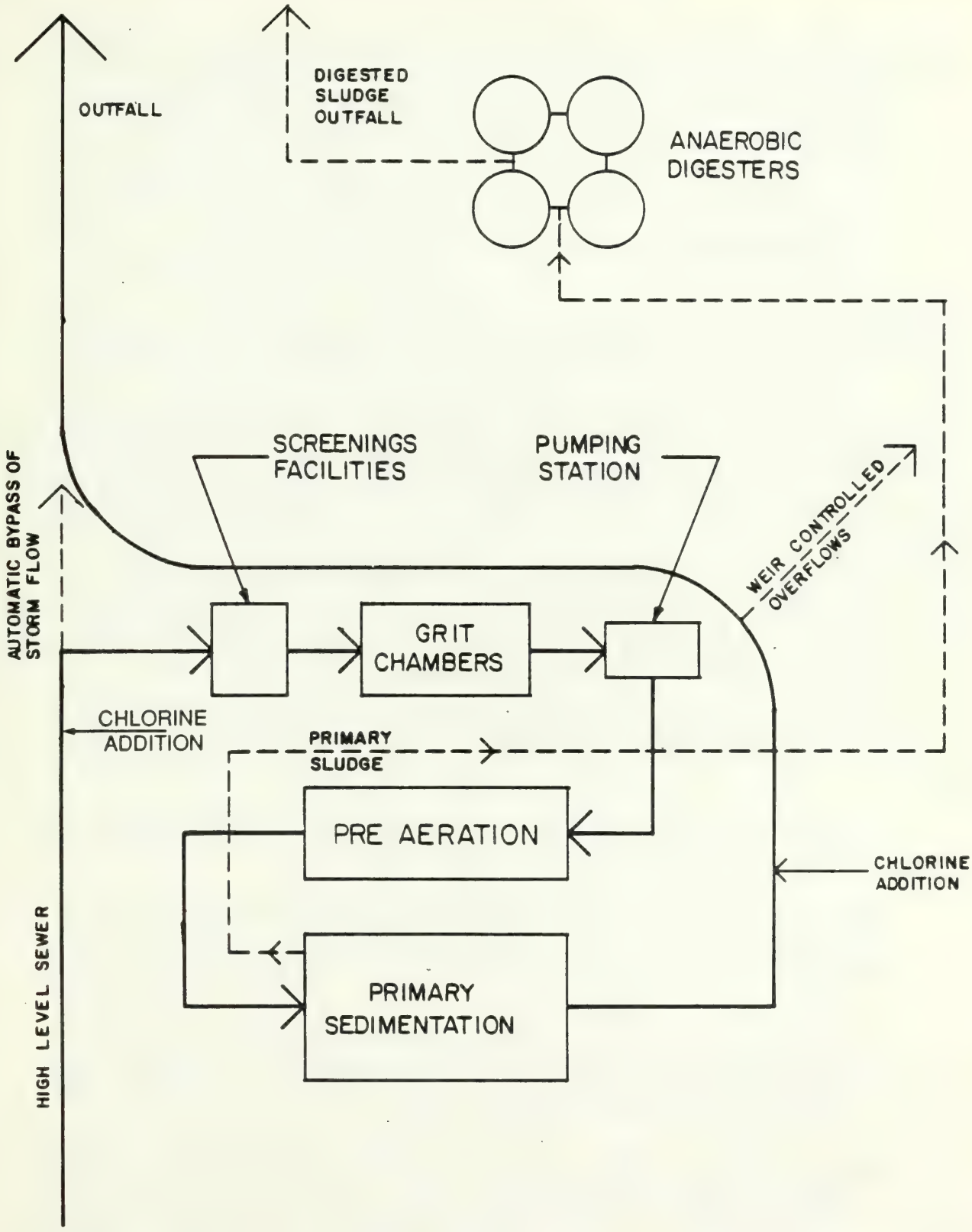
5.1.4 NUT ISLAND TREATMENT PLANT

The Nut Island Wastewater Treatment Plant, originally completed in 1952, serves the South Metropolitan Sewerage System. Collection of wastewater from communities served by the system is routed through the High Level Sewer to the treatment plant. Treatment provided at the plant consists of screening, grit removal, preaeration, primary sedimentation, and disinfection. Plant effluent is discharged to the harbor. A schematic of the plant is presented in Figure 5.1.4-1.

Flow enters the facility at the headworks where it is channeled to two cantenary-type bar screens with 7/8-in bar openings that are operated by timers. Large solids and trash are caught on the screens, raked to an ejector pot and ejected by air to a receiving container.

From the screenings area, wastewater is diverted to six grit chambers. Grit it collected by a chain and bucket mechanism, scraping the floor of the chamber and depositing the grit on a conveyor for transport to the ejector pots. Once a sufficient quantity of grit is collected in the pot, air is used to eject the material to a receiving container. The screenings and grit removed from the wastewater are deposited into a common container. A private contractor hauls the material off-site on a regular basis.

The screened, degritted wastewater flows to the main wet well. From there, it is pumped to the preaeration and primary sedimentation basins.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 5.1.4-1 NUT ISLAND WASTEWATER TREATMENT PLANT SCHEMATIC

Pumping of the plant flow is provided by four main sewage pumps rated at 83 mgd each and having a total capacity of 280 mgd. Pumped sewage is metered through a venturi meter and discharged to five preaeration basins. At the preaeration basins, air is injected into the waste stream by two 5000 cfm blowers. Primary sedimentation is provided by six sedimentation basins. Sludge and grease are anaerobically digested in four digesters and routinely withdrawn, disinfected and discharged through the sludge outfall to the Harbor off Long Island.

Chlorine for disinfection is applied to sedimentation basin efluent prior to its discharge to the Harbor through two of five outfalls.

There are also four outfalls from Nut Island, designated by the EPA as 101 through 104, and a sludge discharge line designated as 105. Construction dates back to the turn of the century.

Outfalls 101 and 102 were built in 1904 as part of the screening and sandcatcher facility. They each extend in a northerly direction approximately one mile offshore into the Nantasket Roads channel area of the harbor. They are constructed of 60-in-diameter cast iron pipe. The pipe is buried and protected with rip-rap. The outlets were originally simple single upturns, flush with the harbor bottom.

Outfall 103 was built in 1914 to add capacity to the 1904 sandcatcher facility. It extends approximately one-quarter of a mile offshore into Quincy Bay, paralleling the original outfalls. It consists of a buried 60-in-diameter cast iron pipe protected with rip-rap. The outlet, like those of 101 and 102, is a simple upturn, flush with the harbor bottom.

In the period between 1946 and 1952, a primary treatment facility was added to Nut Island. Along with it came the construction of two new outfalls, 104 and 105, and modification of two of the existing outfalls.

The outlets to outfalls 101 and 102 were capped to form hexagonal side discharges. It is presumed that this was done to improve mixing of the effluent with the ambient harbor water.

Outfall 104 extends east of Nut Island, about one-tenth of a mile into Hingham Bay, and has a single horizontal outlet. It is a buried 60-in-diameter reinforced concrete pipe intended to be an emergency bypass to carry the overflow when the capacity of the original three outfalls is exceeded.

Discharge 105 is a 12-in-diameter cast iron sludge line. It extends about 4 miles in a northerly direction to a point near the north end of Long Island in the President Roads channel area of the harbor. It has a specially-shaped slotted outlet designed to promote mixing.

Outfalls 101 and 102 underwent a major cleaning operation in 1985-86 to restore their capacity. Prior to this, the short outfalls 103 and 104 were in use for longer periods than originally intended because of the deteriorated capacity of outfalls 101 and 102. The increased use of 103 and 104 was a concern because of their closer proximity to Nut Island and the beaches in the City of Quincy.

The High Level Sewer presently has a maximum capacity of slightly greater than 300 mgd. A portion of these peak flows are bypassed prior to treatment, depending on the number of treatment and pumping units available at the plant at any one time. At the entrance of the High Level Sewer to the plant, there is an emergency spillway at Elevation 120.30 that opens to the effluent outfalls. Overflows to this spillway occur when flow to the plant reaches about 280 mgd with both bar screens available. The High Level Sewer capacity could be increased if existing hydraulic limitations in the Nut Island Plant were removed (see Section 6.2).

Recent Improvements

Since 1984, a number of improvements have been implemented at the Nut Island Wastewater Treatment Plant. these improvements include:

- Addition of an influent flow meter (sonic type) to the High Level Sewer.
- Installation of a new ventilation system, odor control equipment, and explosion-proof electrical components, all in to the grit room.
- Abandonment of comminutors immediately downstream of the grit chambers. The effluent channels from the grit tanks were rebuilt for smoother transition and for a decrease in headloss.
- Rebuilding of one engine generator and one preaeration blower motor.
- Installation of off-site, purchased power service.
- Replacement of most of the air header to the preaeration tanks with new line.
- Construction of improvements to the primary tanks, including:

  Rebuilding tanks structurally, repairing columns and supports for sludge collectors. Repairing leaks, leveling tank floors. Replacing all weirs and replacing sludge collection equipment. Replacement of outside sludge piping from the primary sludge pumps to the anaerobic digesters with 250-lb, glass-lined ductile iron piping. Addition of a programmable controller for automated operation of the sluice gate on Outfall 103.

5.2 EXISTING ENVIRONMENT

5.2.1 PHYSIOGRAPHY AND GEOLOGY

Deer Island

Physiography

The dominant topographic and geologic feature on Deer Island is the central drumlin which crests at approximately elev 210. The major axis of the drumlin is oriented east-west and extends approximately 2,000 ft with a minor axis of about 1,000 ft. Another smaller, partially eroded drumlin is located at the north shore of the island and stands at a maximum elev 170. The small drumlin is believed to have been just as large as, and oriented roughly parallel to, the central drumlin; however, due to significant erosion along the seaward side, the major axis of this drumlin is currently oriented northwesterly and extends approximately 1,400 ft with a minor axis of about 400 ft. The remnant of a third drumlin is barely perceptible at the southernmost tip of the island. This feature shows little topographic expression and no longer presents a distinctive form.

The processes of weathering and erosion have significantly modified the structure of the island. It was during a severe hurricane in 1936 that the channelway known as Shirley Gut was closed off by wind and current action. At this time Deer Island became, in actuality, a peninsula of the mainland. Wave action has severely affected the northern and eastern shorelines to the point that a seawall was erected to suppress the degradation. Similarly, tidal currents have remolded and redeposited glacial sediments in the formation of a sand and gravel extension of the island southward toward President Roads.

Man-made features have necessarily altered the contours of the island over the years. Construction of the existing sewage treatment facility required removal of part of the central drumlin along the northwest flank. In addition, a plant water reservoir was constructed at the crest of this drumlin. A swamp/tidal marsh area north of the central drumlin was backfilled to facilitate construction of the existing treatment plant. Fill materials were placed along roadways, particularly along the western shore of Deer Island. Excavation spoil or "tunnel muck" from previous shaft excavations were placed along an area of the western shoreline near the existing treatment facility. Approximately 600 ft south of the central drumlin, near the eastern shore of the island, stands a man-made earthen bunker formerly used by the military as part of the coastal defense system. This structure is elongate in a north-south direction extending about 700 ft with a minor axis of approximately 250 ft. The maximum relief is about 40 ft above the surrounding topography.

Geology

The Deer Island drumlins were deposited by the retreating glacier onto a very compact unit of clay, sand, gravel, and boulders, which in turn overlies an irregular bedrock surface. Flanking the slopes of the drumlins are marine deposits and stratified glacial drift. These consist chiefly of a marine clay overlain by sand and gravel outwash containing occasional lenses of glacial till. The uppermost unit consists of more recent deposits of silty fine-to-medium sand with some traces of organic material. The bedrock is predominantly argillite and is present throughout the area of the island.

Surficial Deposits. A dense to very dense mixture of clay, silt, sand, gravel, and boulders (glacial till) covers the bedrock surface and comprises the drumlins on Deer Island. Till thicknesses approaching 200 ft have been noted in the area of the central drumlins. As is

typical of glacial till deposits, the proportion of this coarse- to fine-grained material is highly variable. However, isolated pockets and lenses of near-homogeneous fine materials occur throughout the tills. The remaining land area soils, adjacent to and between the drumlin exposures, consist of a gray, silty clay that are overlain by fill or sand and gravel outwash deposits. The clays vary in thickness, reaching a maximum thickness of 50 ft, whereas the sands and gravels generally range from 0 to 20 ft in thickness.

Organic silts, peat, and muck have been observed in borings in low lying areas between the drumlins. Their occurrence is indicative of the formation of a tidal marsh or backswamp during a period of lower sea level. A subsequent rise in sea level permitted deposition of the fine sand and gravel associated with the more recent beach deposits.

Bedrock Geology. Like much of the Boston Harbor area, Deer Island is underlain by slightly metamorphosed and often complexly folded and faulted argillite. This argillite ranges in quality from very thinly bedded and laminated, to occasionally non-bedded, fine-grained rock, characterized as the Cambridge Formation of the Boston Basin Group. Bedding or laminations are quite prominent as alternating light and dark gray bands which generally dip 25° to 50° from the horizontal. Fractures (partings) in the rock are generally observed parallel to the laminations. The rock is well indurated and, with few exceptions, is moderately-hard to hard. Unconfined compressive strengths varied from less than 4000 psi to greater than 35,000 psi with average values of 15,000 - 20,000 psi. Based on borings and a seismic refraction survey, the topographic relief of the bedrock surface varied from approximately elev. +30 beneath the central drumlin to elev -40 along the western side of the island.

Due to the complex sedimentary and structural history of the Harbor area, other rock types are often found interlayered with, faulted into, or intruded into the argillite. Other rock types associated with the Boston Basin Group include tuffs, sandstone, quartzite, and conglomerates, in addition to intrusions by dikes and sills of diabase, basalt and/or andesite. At Deer Island the only known occurrence of rock other than argillite is that of a basalt sill found at tunnel level near the vertical shaft to the Main Drainage Tunnel. However, other bedrock types may also be present on the island.

Nut Island

Nut Island is actually a small peninsula connected to the mainland by a man-made causeway. The present topography is quite flat, with surface elevations along the peninsula varying between 125 ft and 130 ft. Man-made features dominate the area in the form of treatment facilities extending from the north end to the south end of the island-mainland causeway. Stone riprap protects the entire peninsula perimeter from the effects of wave action.

Geology. Similar to many of the Boston Harbor inner islands, the general geologic profile at Nut Island consists of a variety of surficial deposits overlaying glacial till which, in turn, overlies bedrock. The glacial till is associated with the partially eroded drumlin at the north end of the peninsula. The surficial deposits are post-glacial clays or organics, as well as extensive areas of fill.

Soils. The drumlin till consists of a dense to very dense homogeneous mixture of boulders, gravel, sand, silt, and clay. Till thicknesses exceeding 125 ft have been recorded at the north end of Nut Island. Marine clays up to 20-ft-thick have been found along the west and east flanks of the causeway. Minor thickness of organic soils overlie the clays in the east-central portion of the peninsula.

The connecting causeway was created by the placement of fill materials whose origin was most likely the drumlin till to the north. The fill is primarily a mixture of coarse materials with some silt and clay present.

Bedrock. As is the case with Deer Island, Nut Island is underlain by a thinly bedded, fine-grained bedrock characterized as Cambridge argillite. Bedding or laminations are common as alternating light and dark gray bands. Fractures are generally parallel to the laminations. The rock is well indurated and moderately-hard to hard.

Due to the complex sedimentary and structural history, other rock types may be found interlayed with, faulted into, or intruded into the argillite. These rock types include conglomerates, diabase or basalt sills, and quartzite.

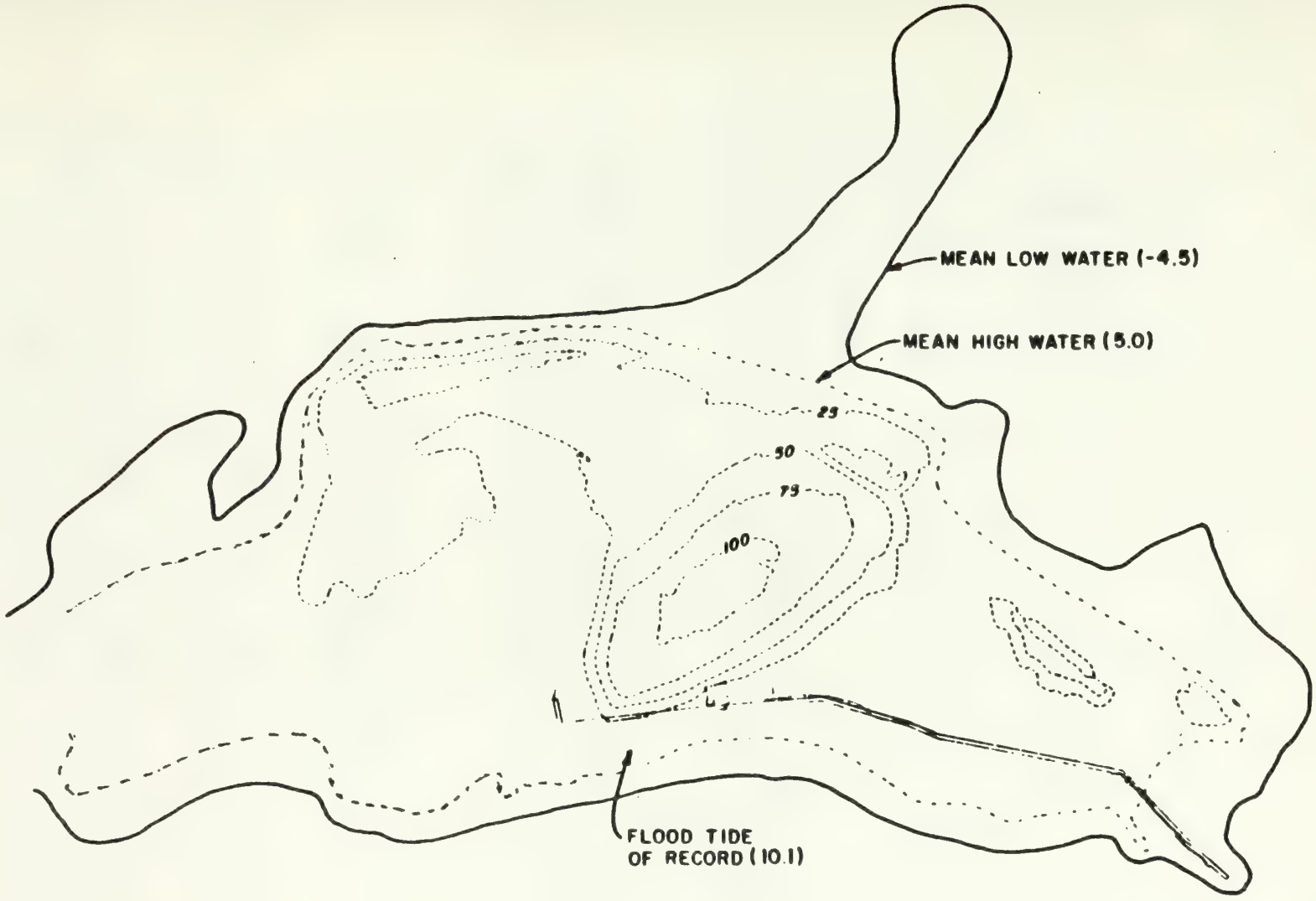
5.2.2 SURFACE AND GROUNDWATER HYDROLOGY

Surface Water

As described in section 5.2.1, the natural contours of Deer Island have been significantly altered over the years. There are no natural surface water bodies on Deer Island. Man-made surface water features consist of the existing primary treatment tanks and a three-million-gallon cooling water reservoir located at the top of the central drumlin. Rainfall runoff in the developed areas of the prison and the treatment plant is collected by roads/catch basins and drained to the harbor. Rainfall runoff in all other areas of Deer Island is discharged to the harbor via natural swales or drainage areas.

The wastewater treatment plant and Fort Dawes, located at the southern end of Deer Island, have created shoreline protection and alterations such as rip-rap, groins, seawalls, and piers. These shoreline alterations nearly encompass Deer Island.

Figure 5.2.2-1 identifies the locations of flood tide of record, mean high water, mean low water relative to USGS datum. The 100-year flood elevation is obtained from the Federal Emergency Management Agency. All other elevations are obtained from a study prepared for the City of Boston (CDM, 1967).



NOTE:
ELEVATIONS ARE FT., USGS DATUM

MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 5.2.2-1
EXISTING DEER ISLAND TOPOGRAPHY

Comparison of these elevations with the MDC sewer datum (MDCSD) is as follows:

	Elevation, ft, MDCSD	Elevation, ft, USGS
Flood tide of record	115.7	10.1
100-year flood	115.6	10.0
Mean high water	110.6	5.0
Mean sea level	105.6	0.0
Mean low water	101.1	-4.5

Design flood level elevations used for the treatment plant facilities are described in Section 8.2 of Volume III.

Groundwater Hydrology

As indicated above, mean sea level at Deer Island is at 105.6 ft. In the low-lying areas adjacent to and between the drumlins of Deer Island, groundwater levels generally vary between elevation 108 to 114 ft, approximately 8 to 11 ft below ground surface. (Metcalf & Eddy, 1983; CDM, 1986).

At the central drumlin there appears to be a perched water table that generally follows the contour of the drumlin. Here the water table lies within a sandy, clayey, gravel (till) at depths varying between 10 to 30 ft below the ground surface. Near the crest of the drumlin the water table may be at an approximate elevation of 172 ft. Storage and recharge capacities are thought to be limited due to the dense and impervious nature of the till.

5.2.3 METEOROLOGY

The climate of the Deer Island area is best described using long-term representative meteorological data collected at the National Weather Service Office at Logan International Airport in Boston, Massachusetts. The airport is located approximately 1.2 miles west of Deer Island.

The climate of the region is continental; however, the Atlantic Ocean has a significant moderating effect. Sea breezes occur on hot spring and summer afternoons, displacing the warm, westerly airflow with a cool, moist, east wind off the water. These breezes generally develop several hours after sunrise and persist for most of the afternoon. The region is situated near 42° N latitude, in the prevailing westerlies, and the weather undergoes alternating intrusions of tropical and polar air masses. In the early fall, hurricanes can bring destructive winds to the area. From late October to late April, major east coast storms bring significant rain and snow. During the warmer season, May through September, rainfall is mostly limited to showers and thunderstorms which accompany frontal passages. Thunderstorms occur on an average of 19

days during the year. On the average, precipitation occurs 1 out of 3 days throughout the year.

New England is affected by high and low pressure systems which originate from areas of North America that differ significantly in climate. The direction of air flow and duration of a particular air flow direction over New England depends on the track (relative to New England) and speed of these high and low pressure systems.

Two types of high pressure systems or air masses frequently affect New England: polar continental and tropical maritime. The general tracks of these two types of systems are shown in Figure 5.2.3-1. A polar continental high pressure system originates in the polar region of the North American continent. This type of system affects New England during all seasons and usually brings dry, abnormally cold air with partly-cloudy sky conditions. The tropical maritime high-pressure system originates from the tropical region of the Atlantic Ocean and usually imports abnormally warm humid air to New England.

Low pressure systems that affect New England generally move from the west or the south, as shown in Figure 5.2.3-2. Winter low pressure systems are larger and more intense than summer systems and tend to track up the Atlantic seacoast. Flows off the ocean, affecting all of New England for extended periods of time, are usually the result of the counterclockwise flow around a low pressure system passing to the east of New England. Low pressure systems that originate in the center of the United States are usually drier and less intense than coastal low pressure systems.

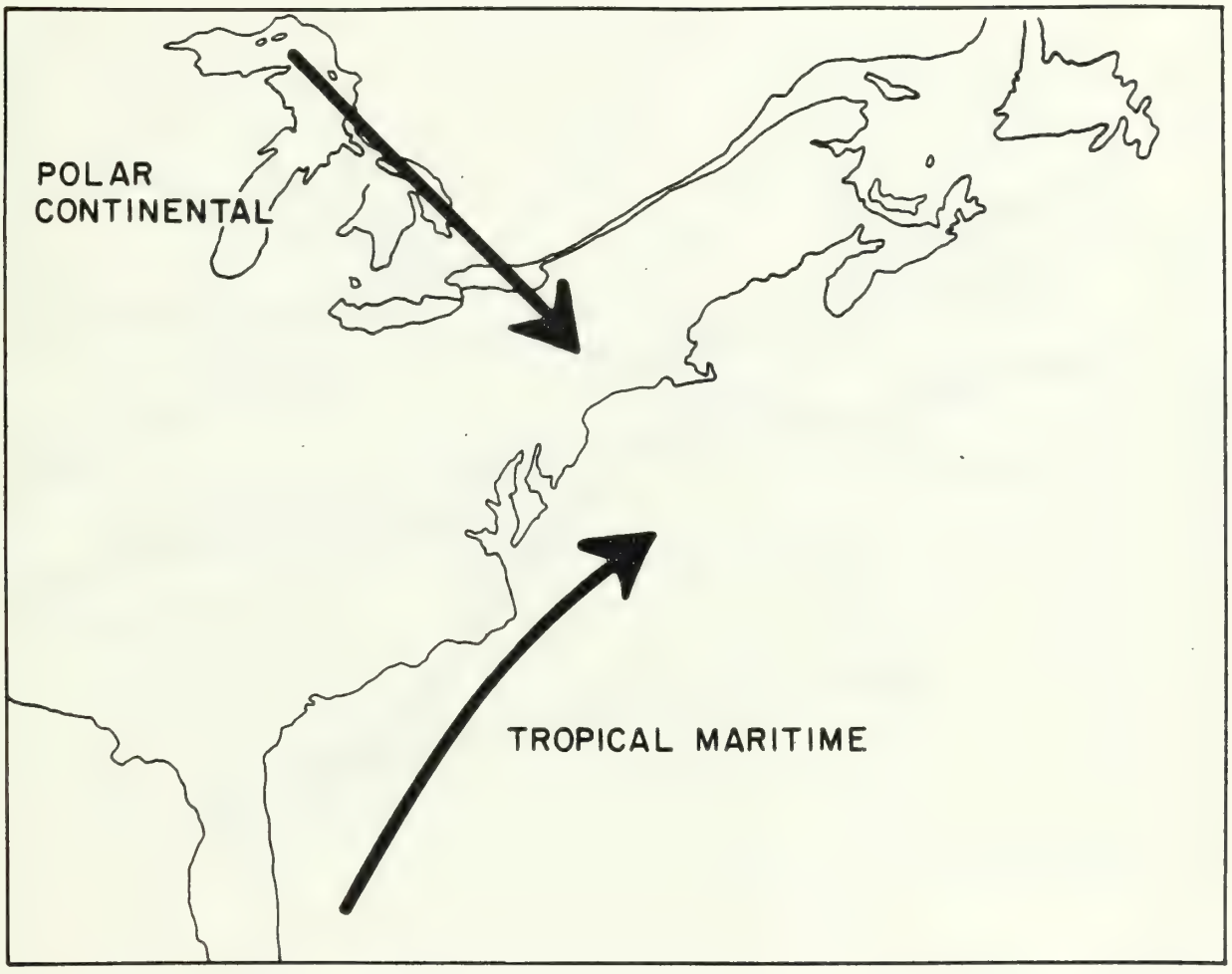
Precipitation

The annual average precipitation in Boston for the period of 1943 through 1982 was 41.40 inches, with amounts ranging from as low as 23.71 inches in 1965 to as high as 62.32 inches in 1954. A maximum 24-hour rainfall value of 8.40 inches occurred in August 1955. Table 5.2.3-1 lists minimum and maximum monthly precipitation statistics for Boston, Massachusetts. Table 5.2.3-2 presents the average monthly and seasonal precipitation values.

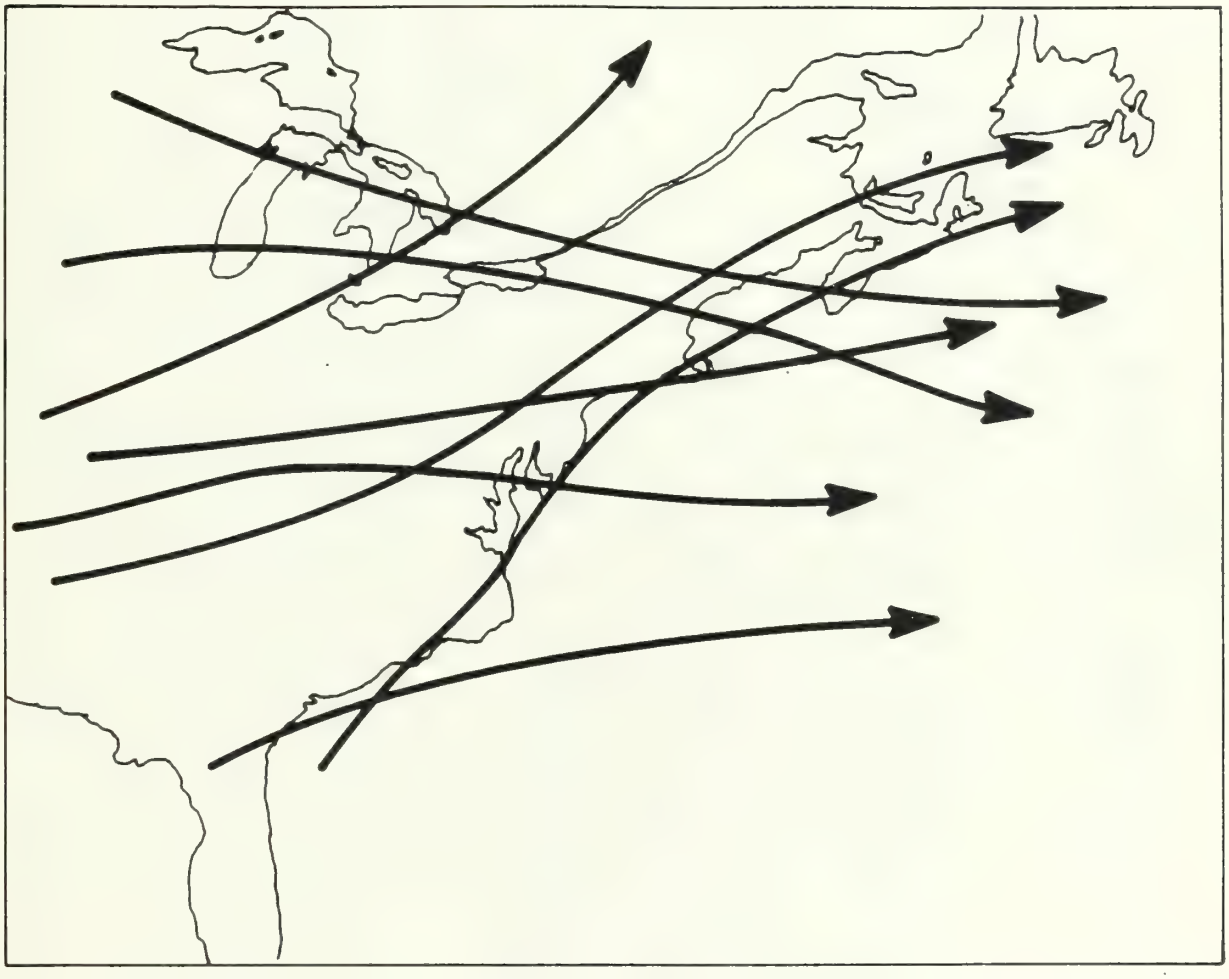
The first measurable snowfall of winter usually occurs at the end of November, and the last snowfall in spring is generally near the middle of March. The average annual snowfall is 42 inches, with amounts ranging from as low as 10.3 inches in 1972-1973 to as high as 89.2 inches in 1947-48. Average monthly snowfall values are also presented in Table 5.2.3-2. A monthly maximum snowfall of 41.3 inches occurred in February, 1969.

Temperature

The mean annual temperature is about 50° F, but seasonal variations bring tropical warmth of 90° F or greater in the summer and polar cold of 0° F or less in winter. The coldest months are January and February, averaging about 29° F. The record minimum temperature of -12° F was recorded in January, 1957. July and August average near 70° F, with a record maximum temperature of 102° F recorded in July, 1977. Freezing temperatures occur on an average of 99 days per year from mid-November through March, and very warm days of 90° F or higher average 12



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 5.2.3-1 GENERAL MOVEMENT OF AIR MASSES WHICH FREQUENTLY AFFECT NEW ENGLAND



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 5.2.3-2 TYPICAL TRACKS OF LOW-PRESSURE SYSTEM AFFECTING NEW ENGLAND

TABLE 5.2.3-1

PRECIPITATION DATA FOR BOSTON
1952 to 1982

	Minimum Monthly Precipitation in Inches and Year of Occurrence		Maximum Monthly Precipitation in Inches and Year of Occurrence	
Jan	0.74	1980	10.55	1979
Feb	0.88	1980	7.08	1969
Mar	0.62	1981	11.00	1953
Apr	1.24	1966	7.82	1958
May	0.25	1944	13.38	1954
June	0.48	1953	13.20	1982
July	0.52	1952	8.12	1959
Aug	0.83	1972	17.09	1955
Sept	0.35	1957	8.31	1954
Oct	0.34	1946	8.68	1962
Nov	0.64	1976	8.18	1969
Dec	0.97	1980	9.74	1969

Minimum yearly precipitation: 23.71 inches (1965)
Maximum yearly precipitation: 62.32 inches (1954)
Average yearly precipitation: 41.40 inches

SOURCE:

Department of Commerce, 1982. National Oceanic and Atmospheric Administration: Local Climatological Data, Annual Summary with Comparative Data, 1982, for General Logan International Airport, Boston, Massachusetts.

TABLE 5.2.3-2

MONTHLY AND SEASONAL CLIMATIC SUMMARY OF BOSTON, MASSACHUSETTS

	Average Daily Maximum Temperature 1941-1970 (°F)	Average Daily Minimum Temperature 1941-1970 (°F)	Average Precipitation 1943-1982 (inches)	Average Snowfall 1943-1982 (inches)	Average Wind Speed 1958-1982 (mph)
December	39.3	26.6	3.65	8.0	13.6
January	35.9	22.5	3.67	12.6	14.2
February	37.5	23.3	3.38	11.6	14.0
Winter Average	37.6	24.1	10.70	32.2	13.9
March	44.6	31.5	3.79	7.7	13.8
April	56.3	40.8	3.55	0.9	13.5
May	67.1	50.1	3.23	Trace	12.1
Spring Average	56.0	40.8	10.57	8.6	13.1
June	76.6	59.3	3.17	0.0	11.4
July	81.4	65.1	3.13	0.0	10.8
August	79.3	63.3	3.57	0.0	10.7
Summer Average	79.1	62.6	9.87	0.0	11.0
September	72.2	56.7	3.18	0.0	11.2
October	63.2	47.5	3.25	Trace	12.0
November	51.7	38.7	3.83	1.2	12.9
Fall Average	62.4	47.6	10.26	1.2	12.0

SOURCE:

Department of Commerce, 1982. National Oceanic and Atmospheric Administration: Local Climatological Data Annual Summary with Comparative Data, 1982, for General Logan International Airport, Boston, Massachusetts.

occurrences annually. The average daily maximum and minimum temperature values by month and season are also presented in Table 5.2.3-2.

Fog

Heavy fog is not uncommon in Boston, but usually lasts less than a day. Contrasting temperature differences over the North Atlantic Ocean often create large fog banks that can move inland across southeastern New England any time of the year. The fog can lower visibility to 1/4 mile or less. Such dense fog occurs on an average of two times per month.

Relative Humidity

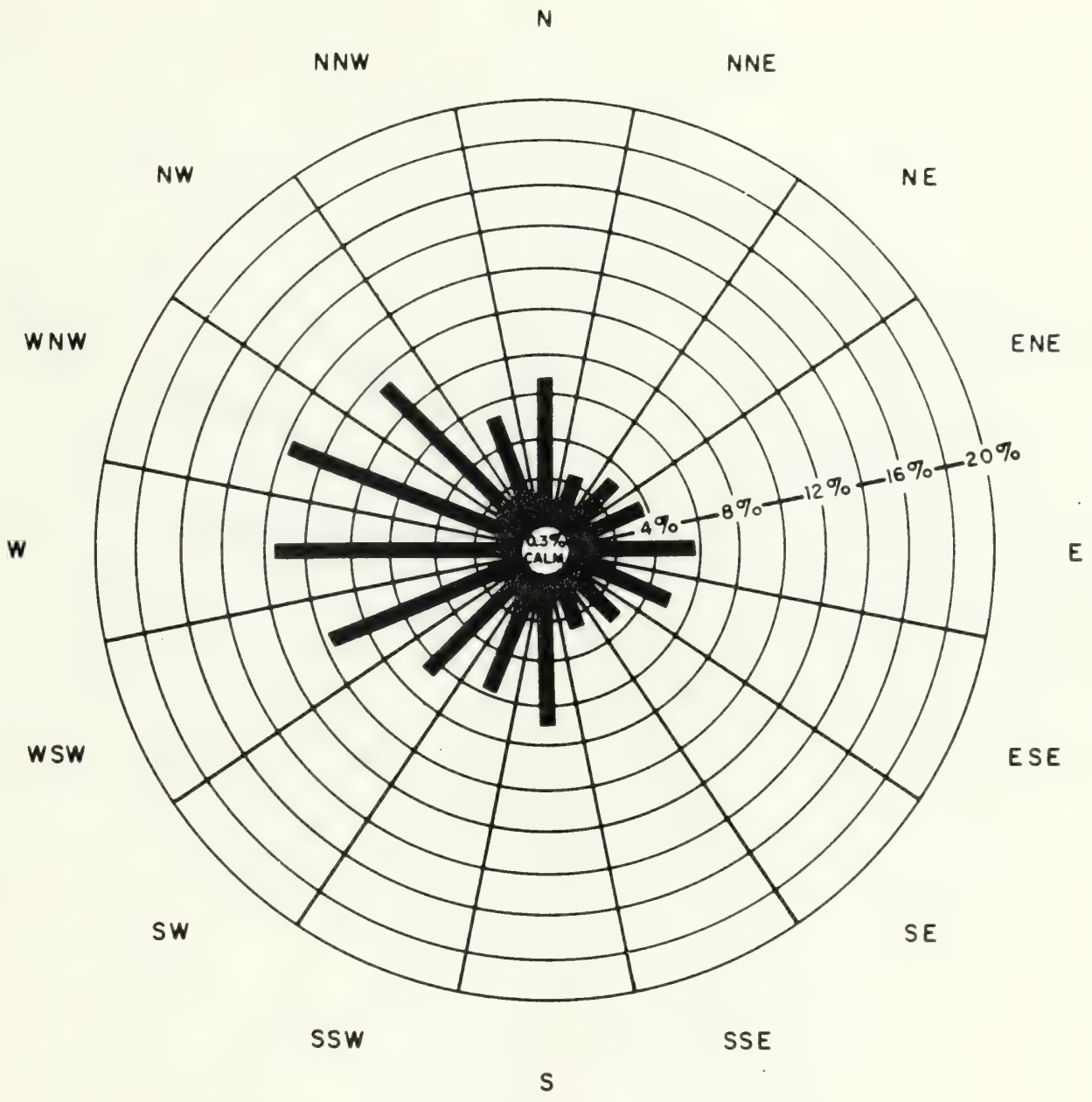
The annual average relative humidity in Boston is 67 percent. The average of the highest daily relative humidity values is 72 percent. These highest daily values are experienced at night and during early morning hours. The drier afternoon and evening hours average 58 percent and 65 percent at 1:00 p.m. and 7:00 p.m., respectively.

Wind Speed and Wind Direction

Figure 5.2.3-3 depicts the annual frequency distribution of wind direction at Boston. The most frequent (11.8 percent) wind direction is west-northwest and the least frequent (2.3 percent) wind direction is south-southeast. Figures 5.2.3-4 through 5.2.3-7 present the seasonal frequencies of wind direction at Boston. During the winter season, (December - February), the wind is predominately from the west-northwest, with winds blowing from the west through (clockwise) northwest approximately 45 percent of the time. During the spring (March - May), the most frequent (11.5 percent) wind direction remains west-northwest. However, the frequency of wind directions from the northeast through (clockwise) southeast is significantly increased from winter because of the sea breeze phenomenon. The most prevalent (11.4 percent) wind direction during the summer is west-southwest, with the winds blowing from the south through (clockwise) west almost half (48 percent) of the time. The effect of the sea breeze on the summer frequency distribution is evident with a pronounced secondary maximum (19.5 percent) occurring between east and southeast. During the fall, the prevalent (10.6 percent) wind direction is west.

The annual average hourly wind speed is 12.5 mph. Calm conditions are infrequent (0.3 percent). Average monthly wind speeds are summarized in Table 5.2.3-2. Wind speeds are highest during the winter, reflecting the increase in the frequency of intense storms affecting New England. Wind speeds are lowest during the summer, which is the period that lacks organized large-scale storm activity, although short-duration high wind gusts can occur during this season as a result of localized thunderstorm activity.

Table 5.2.3-3 presents seasonal and annual wind speeds per wind direction. A west-northwest wind direction is associated with the highest annual average wind speed of 13.9 mph and a south-southeast wind is associated with the lowest annual average wind speed of 8.5 mph. These

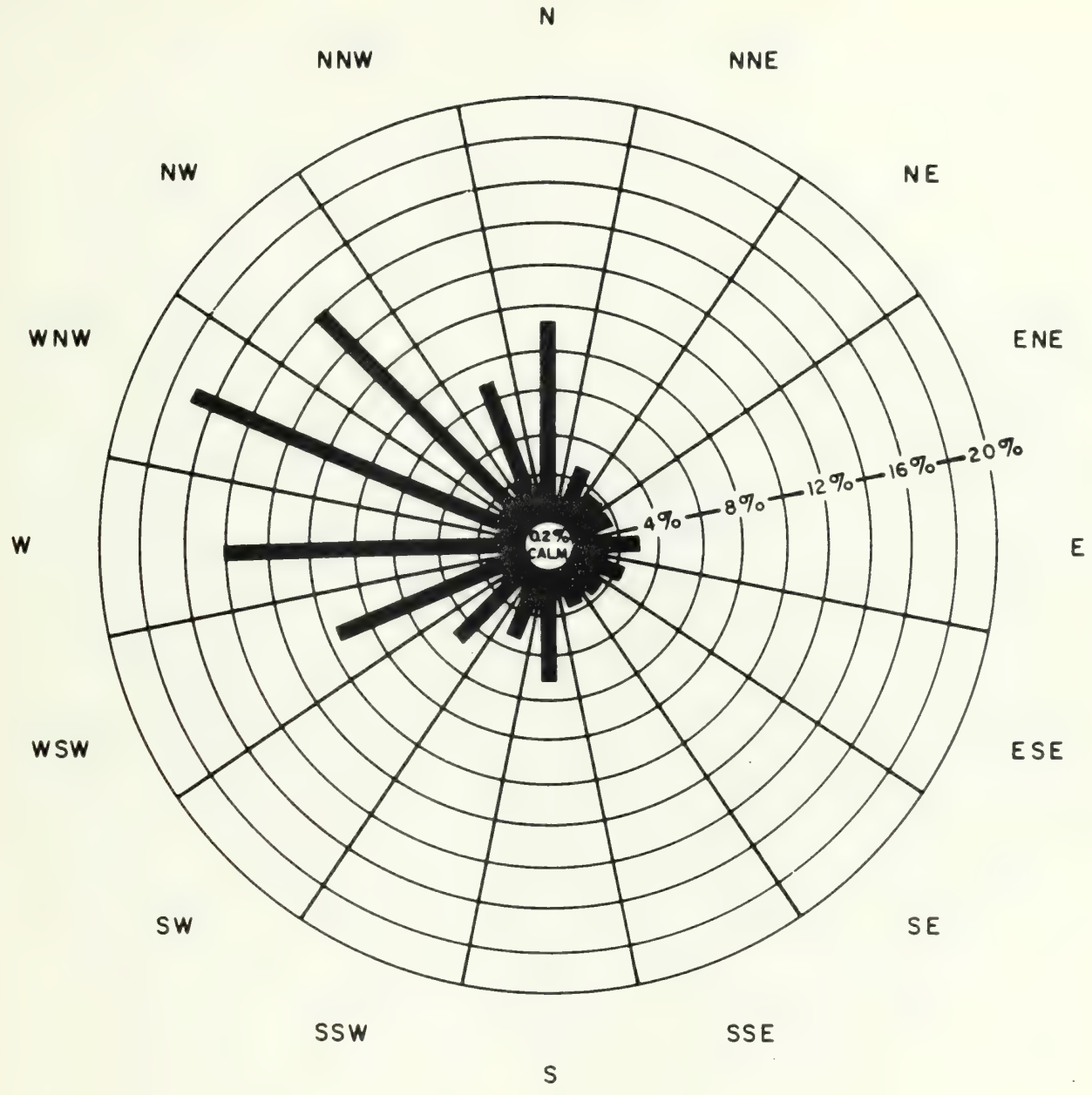


NOTE
DIRECTION REPRESENTS SECTOR
FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 5.2.3-3
ANNUAL FREQUENCY DISTRIBUTION (PERCENTAGE OCCURANCE) OF WIND DIRECTION FOR BOSTON, MASSACHUSETTS (1970-1981)

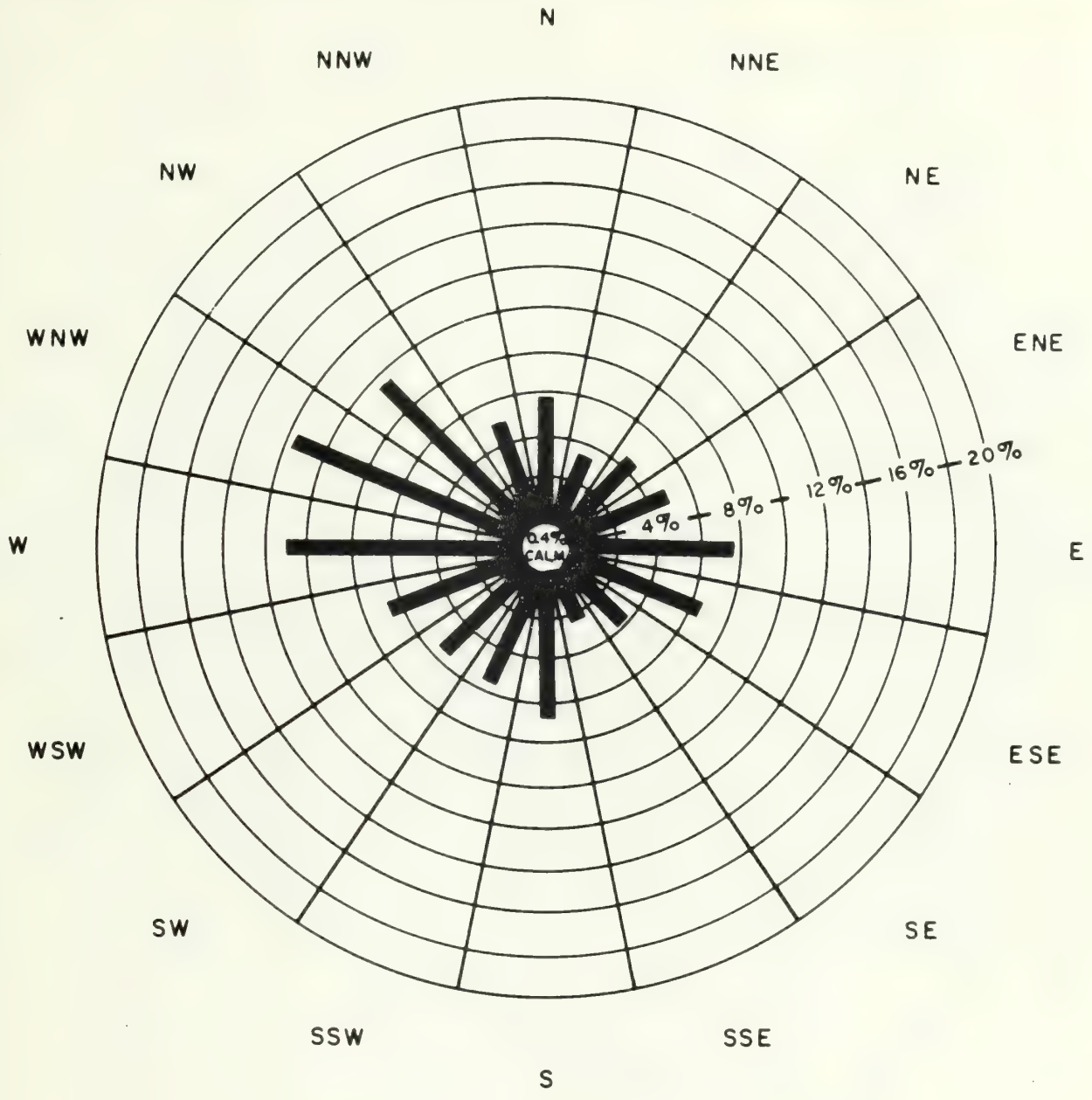


NOTE
DIRECTION REPRESENTS SECTOR
FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

MASSACHUSETTS WATER RESOURCES AUTHORITY

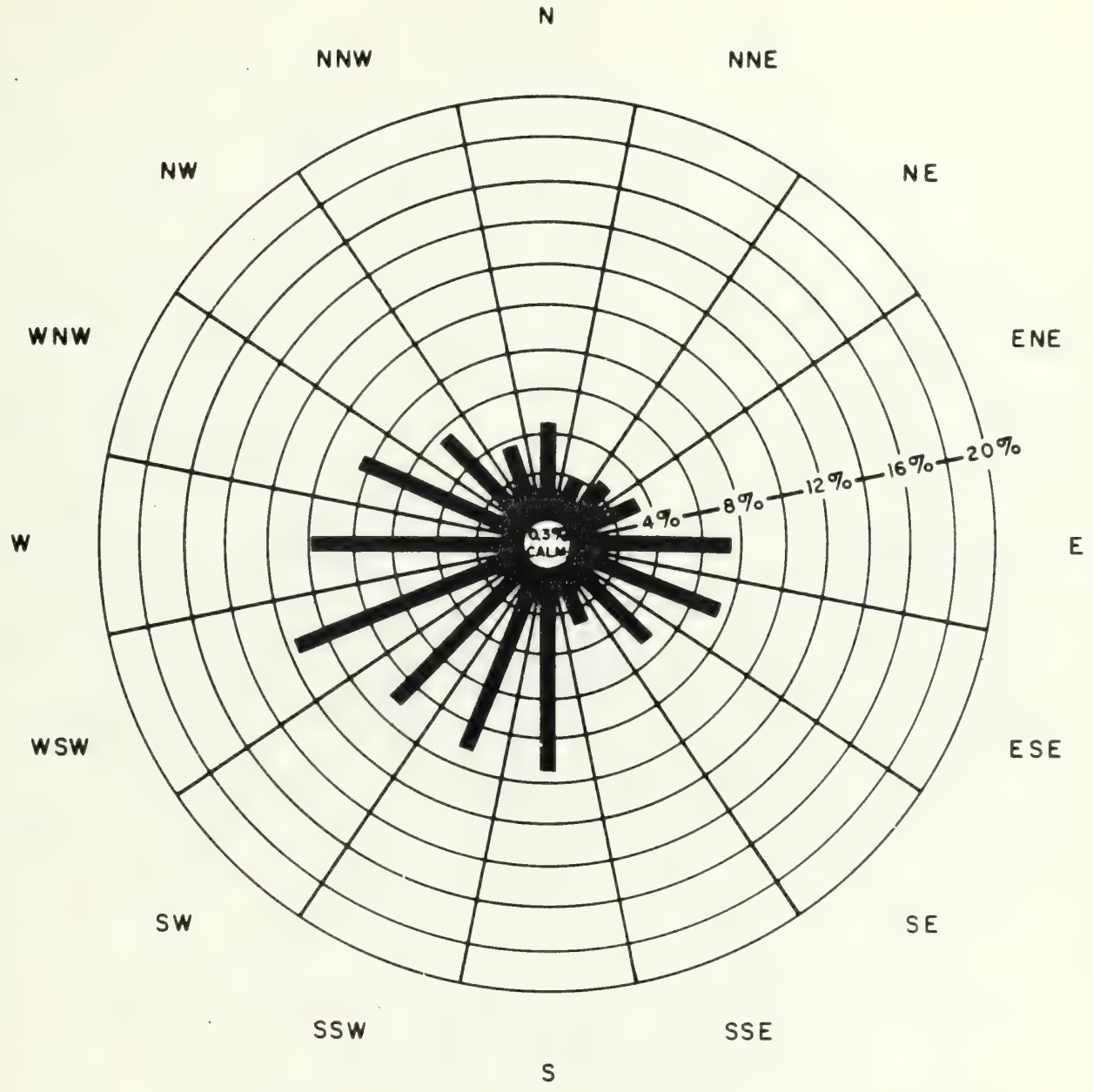
FIGURE 5.2.3-4
WINTER FREQUENCY DISTRIBUTION (PERCENTAGE OCCURANCE) OF WIND DIRECTION FOR BOSTON, MASSACHUSETTS (1970-1981)



NOTE
DIRECTION REPRESENTS SECTOR
FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

MASSACHUSETTS WATER RESOURCES AUTHORITY	**FIGURE 5.2.3-5** **SPRING FREQUENCY DISTRIBUTION (PERCENTAGE OCCURANCE) OF WIND DIRECTION FOR BOSTON, MASSACHUSETTS (1970-1981)**

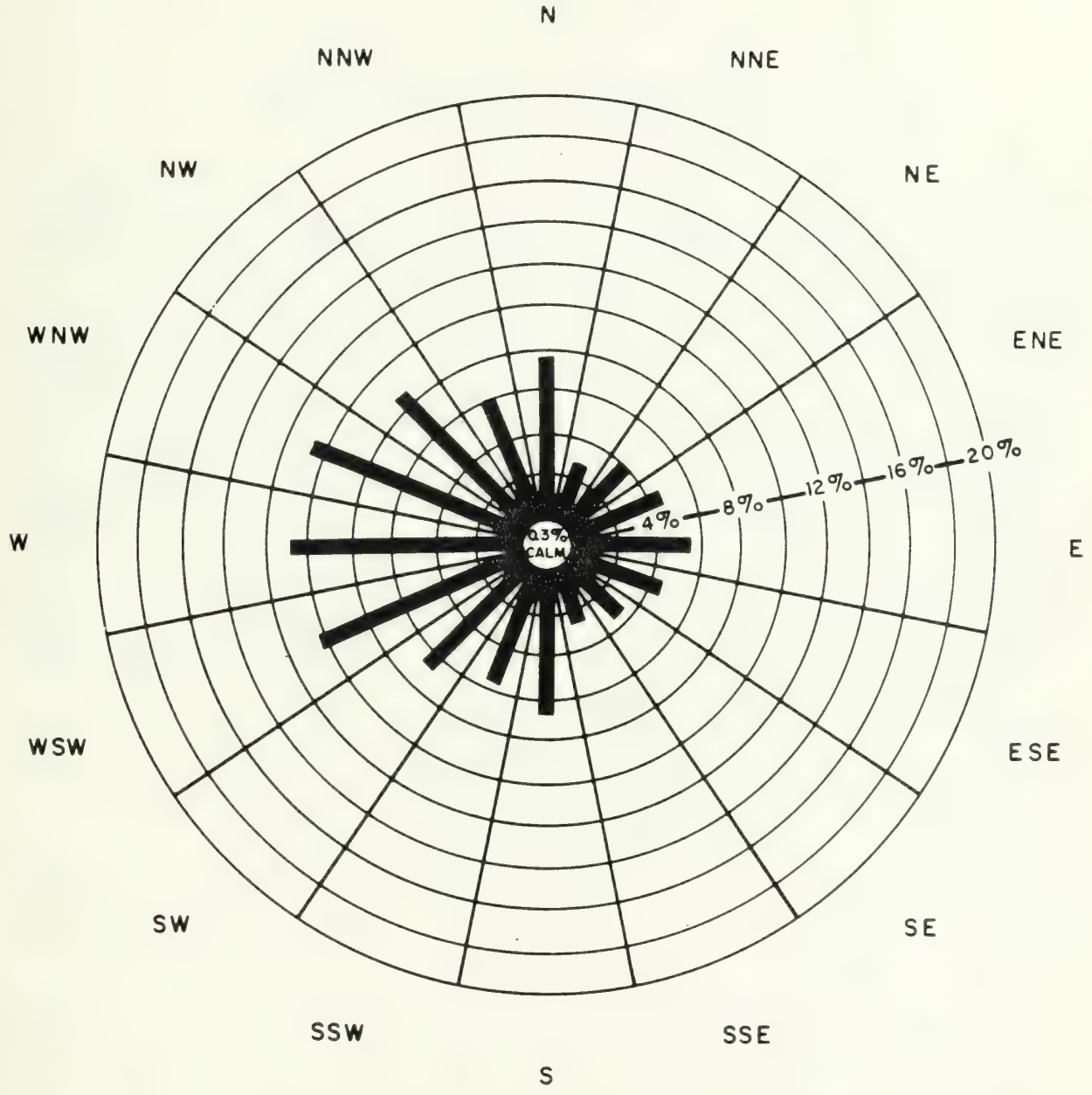


NOTE
DIRECTION REPRESENTS SECTOR
FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

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WATER RESOURCES
AUTHORITY

FIGURE 5.2.3-6
SUMMER FREQUENCY DISTRIBUTION
(PERCENTAGE OCCURANCE) OF WIND DIRECTION
FOR BOSTON, MASSACHUSETTS (1970-1981)



NOTE
DIRECTION REPRESENTS SECTOR
FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

MASSACHUSETTS WATER RESOURCES AUTHORITY	**FIGURE 5.2.3-7** **FALL FREQUENCY DISTRIBUTION (PERCENTAGE OCCURANCE) OF WIND DIRECTION FOR BOSTON, MASSACHUSETTS (1970-1981)**

TABLE 5.2.3-3

SEASONAL AND ANNUAL AVERAGE WIND SPEED (MPH) PER WIND DIRECTION AT LOGAN AIRPORT (1970-1981)

Wind Direction	Winter	Spring	Summer	Fall	Annual
N	11.5	10.8	8.6	10.0	10.4
NNE	10.3	11.1	8.5	9.7	10.0
NE	12.5	12.9	10.5	12.0	12.0
ENE	14.5	12.0	9.1	11.5	11.5
E	14.0	11.6	9.7	11.0	11.1
ESE	11.5	11.7	10.2	10.3	10.8
SE	9.4	9.0	8.2	9.0	8.8
SSE	9.1	8.9	7.3	8.7	8.5
S	10.9	10.8	9.7	9.9	10.2
SSW	13.2	13.3	11.7	12.0	12.4
SW	13.4	12.7	11.5	12.0	12.2
WSW	13.5	12.1	11.1	12.1	12.1
W	15.4	14.7	11.1	13.5	13.8
WNW	15.5	14.6	11.2	13.0	13.9
NW	14.0	13.3	10.8	12.2	12.9
NNW	12.2	12.4	10.4	11.0	11.6

directions correspond with the highest and lowest average wind speed directions of the winter season. During the summer, a south-southwest wind is associated with the highest wind speed of 11.7 mph.

5.2.4 AIR QUALITY

Federal and state air pollution control to date has focused on the six major pollutants for which National Ambient Air Quality Standards (NAAQS) have been established, in accordance with the Clean Air Act (CAA) and its 1977 amendments. Known as the "criteria pollutants," the NAAQS include total suspended particulates (TSP), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (0_3), and lead (Pb). The purpose of primary standards is to safeguard human health by setting limits on the amount of pollution allowed in the surrounding air so as to protect the population with a significant margin of safety. The margin of safety is to ensure protection of more sensitive groups such as children, the elderly, and the ill. Secondary standards are meant to protect public welfare by preventing adverse effects on animals, agricultural crops, man-made materials and property, personal comfort and well being, and other factors. The degree of stringency of the primary standards, as opposed to the secondary standards, is dependent upon results of extensive health analyses.

Under the CAA, individual states must adopt criteria pollutant standards in their State Implementation Plans (SIPs) that are at least as stringent as the NAAQS. Table 5.2.4-1 lists the Massachusetts and National Ambient Air Quality Standards. The primary method of ensuring that the standards are attained and maintained is through the control of the emissions of these pollutants, specifically from mobile and stationary sources.

In addition to criteria pollutants, the CAA requires control of other airborne compounds. Known as "noncriteria pollutants," regulation of these substances has been more difficult to achieve. This is largely due to the uncertainty of the origin of their emissions, the atmospheric chemistry involved during transport, and the significance, if any, of their health effects. Emissions standards for some of the noncriteria pollutants have been established (40CFR61) and are known as the National Emission Standards for Hazardous Air Pollutants (NESHAP). These hazardous air pollutants include asbestos, beryllium, mercury, and vinyl chlorides. The intent of NESHAP is to provide nationally uniform control requirements through specific emission limitations, work practices, and/or equipment standards. The NESHAP control requirements are set at a level that provides an ample margin of safety to protect the public health.

In addition to the regulation of the criteria pollutants, Massachusetts has adopted a toxics regulatory program (Bureau of National Affairs, 1987) based on determinations as to what the acceptable ambient level (AAL) is of specific pollutants. In early 1986, the state compiled a list of 100 of these values, which are more representative of a methodology than of the worst pollutants in the state. This methodology will be used to develop AALs for other pollutants as time goes on.

The AALs are selected from the most appropriate occupational limit and are adjusted to protect the most exposed person in the population. To select the most appropriate levels, the state

TABLE 5.2.4-1
MASSACHUSETTS AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Criteria Pollutant	Averaging (Interval[1])	Primary Standard ($\mu g/m^3$)	Primary Standard (ppm)	Secondary Standard ($\mu g/m^3$)	Secondary Standard (ppm)
Sulfur Dioxide	Annual	80	0.03	-	-
	24-hr	365	0.14	-	-
	3-hr	-	-	1,300	0.5
Inhalable Particulates	Annual	50[2]	-	50[2]	-
	24-hr	150	-	150	-
Total Suspended Particulate	Annual	75[4]	-	60[4,5]	-
	24-hr	260	-	150	-
Nitrogen Dioxide	Annual	100	0.05	100	0.05
	1-hr	320	0.19	-	-
Carbon Monoxide	8-hr	10[7]	9	10[7]	9
	1-hr	40[7]	35	40[7]	35
Ozone	1-hr[8]	240	0.12	240	0.12
Lead	3-month[9]	1.5	-	1.5	-

1. 1-hr, 3-hr, 8-hr, and 24-hr standards not be be exceeded more than once per year. Arithmetic mean for 3-month and annual standards except particulate matter.

2. Expected annual arithmetic mean

3. Not more than one expected exceedance

4. Annual geometric mean

5. For use as a guide in assessing implementation plans to achieve the 24-hr standard.

6. Massachusetts Department of Environmental Quality Engineering guideline, applicable only to major sources or major modifications of oxides of nitrogen.

7. Carbon monoxide standards are shown in units of mg/m^3.

8. Standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above standard are equal to or less than one.

9. Maximum arithmetic mean average over a calendar quarter.

consulted a wide range of data to ascertain acute/chronic toxicity, carcinogenicity, mutagenicity, and developmental/reproductive toxicity. The AALs are expressed as 24-hour average concentrations not to be exceeded, and are presented in Table 5.2.4-2.

Determination of progress in attaining and/or maintaining the NAAQS is accomplished through ambient air quality monitoring. Under the CAA, the state must provide for ambient air quality monitoring at selected locations within specified areas under its jurisdiction, known as Air Quality Control Regions (AQCRs). The state must make available on an annual basis the present ambient conditions on a pollutant-specific basis. In addition to the state-operated network, ambient monitoring data are also collected by local agencies, corporations, universities, etc.

Deer Island is located in the state-designated Metropolitan Boston Air Pollution Control District and the federally designated Metropolitan Boston Air Quality Control Region 119 (AQCR). Ambient air quality monitoring data representative of the region surrounding Deer Island were obtained from the Massachusetts Department of Environmental Quality Engineering.

The ambient air quality data presented in this section are essentially inclusive of the period 1981 through 1985 for the criteria pollutants. Table 5.2.4-3 lists monitoring sites, station identification (Storage and Retrieval of Aerometric Data [SAROAD] numbers, operators, pollutants monitored, and Universal Transverse Mercator (UTM) coordinates.

Ambient air quality data summaries are provided below for each criteria pollutant. Existing air quality concentrations are compared to the appropriate ambient air quality standards which are shown in Table 5.2.4-1. In addition, a summary of the area's attainment status on a pollutant-specific basis is provided in Table 5.2.4-4.

Odors

In Massachusetts, odors are regulated by Boards of Health and the State Department of Health, by the Division of Air Pollution Control, and by the Division of Water Pollution Control. The Boards of Health and the Department of Health obtain their authority from Massachusetts General Law, Chapter 111, Section 122. The Division of Air Pollution Control is empowered by the Massachusetts Air Pollution Control Regulations (310 CMR 7). The Division of Water Pollution Control relies on Massachusetts General Law, Chapter 83, Section 6 and 7.

None of these laws and regulations sets numerical limits for odor. Rather, these regulations state limits for odors in general terms. These limits attempt to eliminate nuisances and to avoid injury to the public health.

The residents of the Town of Winthrop neighboring the Deer Island Wastewater Treatment Facility have expressed complaints about objectionable odors. The odors have, at least in part, been attributed to the treatment facility operation. To address the citizens' concerns relative to these existing conditions, MWRA has retained a consultant to perform an odor monitoring study within the community and the treatment facility, and to recommend appropriate controls. Work began on the odor investigation in the summer of 1987 (TRC, 1987).

TABLE 5.2.4-2

MASSACHUSETTS ALLOWABLE AMBIENT LEVELS

Chemical	CAS Number	Allowable Ambinent Level		TRL	
		$\mu g/m^3$	ppb	$\mu g/m^3$	ppb
Acetaldehyde	75070	4.6	2.5	0.46	0.25
Acetone	67641	8000	3400	-	-
Acrylonitrile	107131	0.15	0.066	0.015	0.0066
Ammonia	7664417	24.0	34.0	-	-
Asiline	62533	1.4	0.36	0.14	0.036
Asbestos	1332214	4.4E-5 f/cc		4.4E-6 f/cc	
Benzene	71432	1.2	0.39	0.12	0.039
Benzyl Chloride	100447	0.70	0.14	-	-
Beryllium	7440417	0.0042	-	0.00042	-
1,3-Butadiene	106990	0.035	0.016	0.0035	0.0016
n-Butyl Alcohol	71363	210	68.0	-	-
Cadmium	7440439	0.0056	-	0.00056	-
Calcium Chromate	13765190	0.00083	-	0.000083	-
Carbon Tetrachloride	56235	0.67	0.10	0.0067	0.0010
Chlordane	57749	0.068	0.0041	-	-
Chlorine	7782505	39.0	14.0	-	-
Chlorobenzene	108907	6.3	1.4	-	-
Chloroethane	75003	360	140	-	-
Chloroform	67663	0.43	0.086	0.043	0.0086
Chloroprene	126998	2.5	0.68	-	-
Chromic Acid	13765190	0.00083	-	0.000083	-
Chromium (Metal)	7440473	0.068	-	-	-
Chromium (VI) Compounds		0.00083	-	0.000083	-
p-Cresol	106445	12.0	2.7	-	-
Cyolohexane	110827	1400	410	-	-
o-Dichlorobenzene	95501	82.0	14.0	-	-
p-Dichlorobenzene	106467	4.2	0.69	0.42	0.069
1,2-Dichloroethane	107062	0.39	0.094	0.039	0.0094
1,2-Dichloroethylene	540590	110	27.0	-	-

TABLE 5.2.4-2

MASSACHUSETTS ALLOWABLE AMBIENT LEVELS
(Continued)

Chemical	CAS Number	Allowable Ambinent Level		TRL	
		$\mu g/m^3$	ppb	$\mu g/m^3$	ppb
Dichloromethane	75092	2.4	0.69	0.24	0.069
1,2-Dichloropropane	78875	5.1	1.1	0.51	0.11
Diethylamine	109897	4.1	1.4	-	-
Di-(ethylhexyl)phthalate	117817	0.68	0.043	0.0077	0.0047
Dimethylformamide	68122	8.1	2.7	-	-
1,4-Dioxane	123911	2.4	0.67	0.24	0.067
Diphenyl	92524	0.086	0.014	-	-
Diphenylamine	122394	0.68	0.098	-	-
Epichlorohydrin	106898	2.7	0.72	0.83	0.22
Ethyl Acetate	141786	2000	540	-	-
Ethyl Acrylate	140885	0.28	0.068	-	-
Ethyl Benzene	100414	120	27.0	-	-
Ethylene Glycol	107211	170	68.0	-	-
Ethyl Ether	60297	160	54.0	-	-
Fluoride	16984488	34.0	44.0	-	-
Formaldehyde	50000	0.77	0.63	0.077	0.063
Heptachlor	76448	0.0068	0.00045	-	-
Hexachlorocyclopentadiene	77474	0.015	0.0014	-	-
Hexachloroethane	67721	0.18	0.018	-	-
2-Hexanone	591786	54.0	13.0	-	-
Hydrazine	302012	0.018	0.014	-	-
Hydrogen Chloride	7647010	10.0	6.8	-	-
Hydrogen Fluoride	7664393	3.4	4.2	-	-
Hydrogen Sulfide	7783064	19.0	14.0	-	-
Isoamyl Acetate	123922	720	140	-	-
Isobutyl Acetate	110190	970	200	-	-
Isobutyl Alcohol	78831	210	68.0	-	-
Isoprophyl Acetate	108214	1400	340	-	-
Lead	7439921	0.068	-	-	-

TABLE 5.2.4-2

MASSACHUSETTS ALLOWABLE AMBIENT LEVELS
(Continued)

Chemical	CAS Number	Allowable Ambinent Level		TRL	
		$\mu g/m^3$	ppb	$\mu g/m^3$	ppb
Lead subacetate	1335326	0.0068	-	-	-
Lindane	58899	0.068	0.0057	-	-
Meleic Anhydride	108316	0.14	0.034	-	-
Methyl Acrylate	96333	4.8	1.4	-	-
Methyl Bromide	74839	2.6	0.68	-	-
Methyl Methacrylate	80626	7.00	28	-	-
Napthalene	91203	14.0	2.7	-	-
Nickel	7440020	0.018	-	-	-
Nickel Oxide	1313991	0.014	-	-	-
Nitrobenzene	98953	6.8	1.4	-	-
Pentachlorophenol	87865	0.034	0.0031	-	-
Phenol	108952	52.0	14.0	-	-
Phosphoric Acid	7664382	1.4	0.34	-	-
Phthalic Anydride	85449	0.82	0.14	-	-
PCBs	1336363	0.0081	-	0.00081	-
Proply Alcohol	71238	670	270	-	-
Propylene Oxide	75569	15.0	6.3	1.5	0.63
Resorcinol	108463	3.1	0.68	-	-
Selenium	7782492	0.27	-	-	-
Selenium Sulfide	7446346	0.50	-	0.050	-
Styrene	100425	39.0	9.1	-	-
Sulfuric Acid	7664939	14	3.4	-	-
1,1,2,2-Tetrachloro-1,2-difluoroethane	76120	570	68.0	-	-
1,1,2,2-Tetrachloroethane	79345	1.2	0.18	-	-
Tetrachloroethylene	127184	0.18	0.027	0.018	0.0027
Tetrahydrofuran	109999	80.0	27.0	-	-
Toluene	108883	51.0	14.0	-	-
o-Toluidine	95534	1.75	0.40	0.17	0.040
1,1,2-Trichloroethane	79005	0.99	0.18	-	-

TABLE 5.2.4-2

MASSACHUSETTS ALLOWABLE AMBIENT LEVELS
(Continued)

Chemical	CAS Number	Allowable Ambinent Level		TRL	
		$\mu g/m^3$	ppb	$\mu g/m^3$	ppb
Trichloroethylene	79016	6.1	1.1	0.61	0.11
2,4,6-Trichlorophenol	95954	1.6	0.20	0.16	0.020
Triethylamine	121448	5.6	1.4	-	-
Vanadium	1314621	0.14	-	-	-
Vanadium Pentoxide	1314621	0.019 as V		-	-
Vinyl Acetate	108054	9.6	2.7	-	-
Vinyl Chloride	75014	3.9	1.5	0.39	0.15
Vinylidene Chloride	75354	0.20	0.050	0.020	0.0050
Xylenes(m-,o-,p-ISOMERS)		59.0	14.0	-	-
Ethanol	64175	260	140	-	-
Methanol	67561	36.0	27.0	-	-
Methyl Ethyl Ketone (MEK)	78933	160	54.0	-	-
Methyl Isobutyl Ketone (MIBK)	108101	280	68.0	-	-

TABLE 5.2.4-3

AMBIENT AIR QUALITY MONITORING STATIONS

Monitoring Site (SAROAD No.)	Operated By	Pollutant(s) Monitored	UTM Coordinates X	UTM Coordinates Y
1. Deer Island Boston (0240-026)	DEQE	SO_2, NO_2	337.9	4690.2
2. Atlantic Ave Boston (0240-018)	BECO	TSP, SO_2, SO4	30.8	4690.8
3. Long Island Boston (0240-019)	BECO	TSP, SO_2, SO4	337.6	4686.6
4. Bremen St. East Boston (0240-021)	DEQE BECO	TSP, SO_2, NO_2, C0,0_3 TSP, SO_2, SO_4	332.7	4693.4
5. Chestnut and 6th Chelsea (0380-002)	DEQE	TSP, Pb	332.5	4695.1
6. Power Horn Hill (0380-003)	DEQE Chelsea	SO_2, NO_2, O_3	339.9	4675.8

TABLE 5.2.4-4

ATTAINMENT STATUS DESIGNATIONS OF AQCR 119

Criteria	Area	Status
TSP	Boston	Cannot be classified or better than national standards
SO_2	Entire State	Better than national standards
NO_2	Entire State	Cannot be classified or better than national standards
CO	Boston	Does not meet primary standards
O_3	Entire State	Does not meet primary standards
Pb	Entire State	Currently no designations

MWRA is committed to construct and operate the new treatment facility to control odors so as to eliminate detectable odors offsite, and to control atmospheric emissions as necessary to protect the public health. Specific mitigation committments by MWRA for the construction and operation of the treatment facility are described in Volume VII of the EIR/EID.

Total Suspended Particulates (TSP)

A summary of TSP ambient air quality data is presented in Table 5.2.4-5. No violations of primary or secondary standards were recorded during the time frame.

No ambient data depicting the TSP concentrations in the immediate vicinity of Deer Island are presently available. TSP concentrations recorded from 1981 through 1985 at the nearby Long Island monitoring station, located less than 2 miles from Deer Island, were in compliance with all standards.

In a study performed in 1977 to determine the elemental composition of TSP in metropolitan Boston, it was reported that between 51 and 59 percent of all particulates originate from the soil and are entrained into the atmosphere by vehicle activity, construction and demolition, and the action of the wind (Wiltsee, 1977). In addition, it was determined that the burning of residual oil fuel for power generation from all sources contributes only 2 to 5 percent of the TSP concentrations in metropolitan Boston.

Sulfur Dioxide (SO_2)

Ambient monitoring data for SO_2 are summarized in Table 5.2.4-6. There were no violations of either the 3-hour, 24-hour, or annual ambient standards of 1300 micrograms per cubic meter ($\mu g/m^3$), 365 $\mu g/m^3$ and 80 $\mu g/m^3$, respectively, at any site in the vicinity of Deer Island during the period from 1981 through 1985. It is clear that SO_2 concentrations in the vicinity of Deer Island are well within all standards.

An evaluation of the trends of SO_2 concentrations in metropolitan Boston shows that regional levels fell consistently from 1971 to 1974, with the steepest decline occurring in the urban core. Annual average concentrations for the entire metropolitan Boston area fell from 41 $\mu g/m^3$ in 1971 to 18 $\mu g/m^3$ in 1974. At the same time, SO_2 concentrations in downtown Boston declined from 63 $\mu g/m^3$ in 1971 to 19 $\mu g/m^3$ in 1974.

The dramatic decrease in annual average SO_2 concentrations between 1971 and 1974 was a result of sulfur-in-fuel regulations. Because of the lower SO_2 ambient levels in 1974 and the increased cost of low-sulfur fuel oil, new legislation (Massachusetts General Laws of 1974, Chapter 494) allowed utilities and industries meeting specific stringent conditions (e.g., protection of standards and public health) to burn higher sulfur fuel oil. As a result, ambient SO_2 levels increased slightly between 1975 and 1978 but remained well within all ambient standards.

TABLE 5.2.4-5

AMBIENT AIR QUALITY DATA SUMMARY FOR TOTAL SUSPENDED PARTICULATES

Monitoring Site	Year	24-hr Average Concentration Highest ($\mu g/m^3$)	2nd Highest ($\mu g/m^3$)	Annual Geometric Mean ($\mu g/m^3$)
Atlantic Ave Boston	1981	---	---	---
	1982	---	---	---
	1983	---	---	---
	1984	177	139	56
	1985	---	---	---
Long Island Boston	1981	---	---	---
	1982	---	---	---
	1983	---	---	---
	1984	50	49	25
	1985	---	---	---
Bremen St East Boston	1981	---	---	---
	1982	---	---	---
	1983	100	95	52
	1984	107	97	40
	1985	---	---	---
Chestnut and 6th Chelsea	1981	149	128	57
	1982	118	104	50
	1983	127	106	50
	1984	125	118	54
	1985	---	---	---

TABLE 5.2.4-6

AMBIENT AIR QUALITY DATA SUMMARY FOR SULFUR DIOXIDE

Monitoring Site	Year	3-hr Running Average Highest ($\mu g/m^3$)	3-hr Running Average 2nd Highest[1] ($\mu g/m^3$)	24-hr Daily Average Highest ($\mu g/m^3$)	24-hr Daily Average 2nd Highest[1] ($\mu g/m^3$)	Annual Arithmetic Mean[2] ($\mu g/m^3$)
Deer Island	1981	---	---	---	---	---
Boston	1982	179	178	96	60	---
	1983	---	---	---	---	---
	1984	---	---	---	---	---
	1985	---	---	---	---	---
Atlantic Ave.	1981	359	280	191	147	41
Boston	1982	---	---	---	---	---
	1983	---	---	---	---	---
	1984	288	288	168	134	35
	1985	---	---	---	---	---
Long Island	1981	233	196	113	104	23
Boston	1982	---	---	---	---	---
	1983	---	---	---	---	---
	1984	236	210	254	238	19
	1985	---	---	----	---	---
340 Bremen St.	1981	215	204	126	102	37
East Boston	1982	364	281	128	116	37
	1983	---	---	---	---	---
	1984	279	261	171	141	34
	1985	---	---	---	---	---
Power Horn Hill	1981	---	----	---	---	---
Chelsea	1982	---	----	---	---	---
	1983	---	---	---	---	---
	1984	367	263	109	102	24
	1985	---	---	---	---	---

NOTES:

1. Standard compliance is determined by comparing the second-highest recorded value to the 3-hour standard of 1300 $\mu g/m^3$ and the 24-hour standard of 365 $\mu g/m^3$.

2. Annual standard is 80 $\mu g/m^3$.

Since 1978, the overall annual average SO_2 concentrations in metropolitan Boston have consistently remained between 33 and 36 $\mu g/m^3$, which is only 40 to 46 percent of the annual standard. However, concentrations did vary significantly from station to station. Kenmore Square monitoring station, for example, has consistently recorded annual average concentrations between 50 and 55 $\mu g/m^3$, while concentrations recorded at Long Island ranged between 22 and 26 $\mu g/m^3$.

Nitrogen Dioxide (NO_2)

A summary of annual NO_2 ambient data from 1981 to 1985 is provided in Table 5.2.4-7. No NO_2 monitoring station in the vicinity of Deer Island recorded a violation of the annual standard of 100 $\mu g/m^3$. The entire region is currently designated as "better than national standards" for NO_2.

In addition to the state and federal standards for annual average concentrations, Massachusetts DEQE has followed its own policy for short-term NO_2 concentrations applicable to new or modified major sources of oxides of nitrogen (NOx). Specifically, new or modified major sources of NOx that increase emissions to the atmosphere by more than 250 tons per year must demonstrate that the operation of the source will not, with consideration of ambient background, cause or significantly contribute to NO_2 concentrations in excess of 320 $\mu g/m^3$ for any 1-hour period on more than 1 day per year.

Ambient levels of NO_2 are primarily a result of NOx emissions from motor vehicles and stationary combustion sources. It is estimated that motor vehicle emissions constitute 45 percent of all NOx emissions, while stationary combustion sources contribute 50 percent. Electric utilities are responsible for approximately 56 percent of the NOx emissions from stationary combustion sources (EPA, 1979). It follows, then, that approximately 30 percent of all NOx emissions are attributable to electric utilities. Because of their elevated stacks, stationary sources are generally far less significant contributors to ground-level ambient concentrations of NO_2 than motor vehicles.

Determination of trends in NO_2 concentrations from 1971 to 1977 is more difficult to accomplish and conclusions are probably less reliable than for the other criteria pollutants due to the sparsity of the data base and the lack of continuous measurement equipment. However, DEQE is of the opinion that, based on the available non-continuous data, the ambient concentrations at almost all its monitoring stations were in compliance with the annual standard of 100 $\mu g/m^3$ for the period from 1971 to 1977 (DEQE, 1978). In 1977, when continuous monitoring became more readily available, only those sites located close to heavily traveled roadways (i.e., the NOx source of most concern) were retained. The more reliable continuous monitoring data from the period of 1977 to 1980 did not reveal any discernible trend in annual NO_2 concentrations.

Ozone

Two monitoring stations in the general vicinity of Deer Island have collected ozone data during the 5-year period analyzed (1981-1985). One violation of the ambient standard for ozone has occurred during the period. The highest and second-highest 1-hour concentrations of ozone are

TABLE 5.2.4-7

AMBIENT AIR QUALITY DATA SUMMARY FOR NITROGEN DIOXIDE

Monitoring Site	Year	1hr Average Concentration Highest ($\mu g/m^3$)	1hr Average Concentration 2nd Highest ($\mu g/m^3$)	Annual Arithmetic Mean[1] ($\mu g/m^3$)
Deer Island	1981	---	---	---
Boston	1982	433	395	60
	1983	304	234	30
	1984	---	---	---
	1985	---	---	---
Bremen St	1981	214	207	55
East Boston	1982	303	258	43
	1983	332	286	50
	1984	333	263	61
	1985	---	---	---
Power Horn Hill	1981			
Chelsea	1982			
	1983			
	1984	667	517	42
	1985			

NOTE:

1. Annual standard is 100 $\mu g/m^3$.

listed in Table 5.2.4-8. The EPA attainment status designation lists the entire area as "nonattainment."

Ozone is a widespread problem, not limited to any one specific area. Ozone moves easily over great distances, and local violations are often the result of such mobility.

The presence of ozone in the atmosphere is the result of both natural and anthropogenic sources. The natural sources are generally believed to be: from stratospheric ozone mass exchange with the troposphere, resulting in the downward transport of ozone; and precursor emissions of methane from wetlands and NO_x from lightning and microbial activity in soil (Altshuller, 1987). Anthropogenic sources are generally related to emissions of hydrocarbons (HC) and nitrogen dioxide (NO_2), and, to a lesser extent, carbon monoxide (CO), all of which are precursors to ozone formation through photochemical oxidation.

Various atmospheric processes have been linked with the downward transport of ozone from the stratosphere to the troposphere (Reiter, E.R., 1975). One such process, involving large-scale eddy transport in the vicinity of the jet stream, is considered a dominant process at mid-latitudes in the Northern Hemisphere (Danielsen and Mohnen, 1977). These large-scale eddies are associated with the passage of 500-mb low pressure troughs; these low-pressure troughs have been estimated to average one trough per day over North America (Viezee, et al., 1983). The ozone fluxes associated with these tropospheric folding events have been found to reach a peak in April/May and to decrease through the summer to a minimum in October/November (Danielsen and Mohnen, 1977).

The anthropogenic sources of ozone precursors (HC, NO_2, and CO) in photochemical processes can be broken into two general categories: traditional air pollution sources, and those associated with agricultural activities (Altshuller, 1987). The traditional air pollution sources primarily include automotive vehicles and industrial and utility sources. Among the hydrocarbons, volatile organic compounds (VOCs) are considered a major precursor to ozone. These organics are contained in paints and coatings used in many industries, are are also emitted during fossil-fuel combustion. Hydrocarbons are regulated specifically for their ozone-generating capability. These ozone precursors are often transported over long distances, contributing to ozone levels at locations distant from their source. Agricultural sources of ozone precursors include biomass burning (agricultural wastes and forest acreage), methane from rice paddies, and cattle and other food production processes (Altshuller, 1987).

The effects of ozone pollution on human health are manifested in throat irritation, coughing, pain during breathing, and in some cases, headaches caused by ozone at elevated levels of about 900 $\mu g/m^3$ (Bureau of National Affairs, 1987). Ozone has also been documented to have adverse effects on forest species, as in the case of the San Bernadino National Forest (Pinkerton and LeFohn, 1987).

Because ozone is a very persistent air quality problem, many existing sources of VOCs are subject to stringent regulations based on control technique guidelines. In addition, new or modified sources of VOCs are increasingly subject to New Source Performance Standards.

TABLE 5.2.4-8

AMBIENT AIR QUALITY
DATA SUMMARY FOR OZONE

Monitoring Site	Year	1hr Average Highest (ppm)	1hr Average 2nd Highest[1] (ppm)
340 Bremen St.	1981	0.115	0.095
East Boston	1982	0.145	0.117
	1983	0.112	0.110
	1984	0.107	0.073
	1985	---	---
Power Horn Hill	1981	---	---
Chelsea	1982	---	---
	1983	---	---
	1984	0.125	0.125
	1985	---	---

NOTE:

1. Standard compliance is determined by comparing the second highest recorded value to the 1-hour standard of 0.12 ppm.

Lead

Unlike the other criteria pollutants for which standards were established during the early 1970s, the ambient standard for lead was promulgated in October, 1978. The ambient standard is 1.5 $\mu g/m^3$, maximum arithmetic mean concentration averaged over a calendar quarter. In addition to the relatively recent promulgation of the lead standard, ambient air quality monitoring, data reporting, and surveillance provisions for this pollutant have been slow to evolve because of technical uncertainties. Primarily as a result of this, the existing data base for lead is limited to one site in the general vicinity of Deer Island: Chestnut and 6th Street, Chelsea. Ambient monitoring data collected from 1981 to 1985 at this site are presented in Table 5.2.4-9. No violations of the standard have been recorded at this monitoring site. Lead ambient standard attainment designations have not yet been promulgated for Massachusetts.

Lead is emitted to the atmosphere by vehicles burning leaded fuel and by certain stationary sources, which include lead smelters, gasoline lead additive manufacturers, lead storage battery manufacturers, and incinerators burning lead containing wastes.

Section 5.2.4 References

The Bureau of National Affairs, Inc., "Air Pollution Control BNA Policy and Practice Series," 1987.

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TABLE 5.2.4-9

AMBIENT AIR QUALITY
DATA SUMMARY FOR LEAD[1]

Monitoring Site	Year	Quarter	Quarterly Arithmetic Mean[2] ($\mu g/m^3$)
Chestnut and 6th	1981	Second	---
Chelsea		Fourth	---
	1982	First	0.54
		Second	0.33
		Third	0.46
		Fourth	0.42
	1983	First	0.26
		Second	0.23
		Third	0.37
		Fourth	0.40
	1984	First	0.27
		Second	0.26
		Third	0.27
		Fourth	0.34
	1985	---	---

NOTES:

1. Federally compiled data, EPA/atmospheric surveillance.

2. Standard compliance is determined by comparing the recorded quarterly arithmetic mean to 1.5 $\mu g/m^3$.

5.2.5 LAND USE AND VISUAL CHARACTER

Deer Island

Land Use

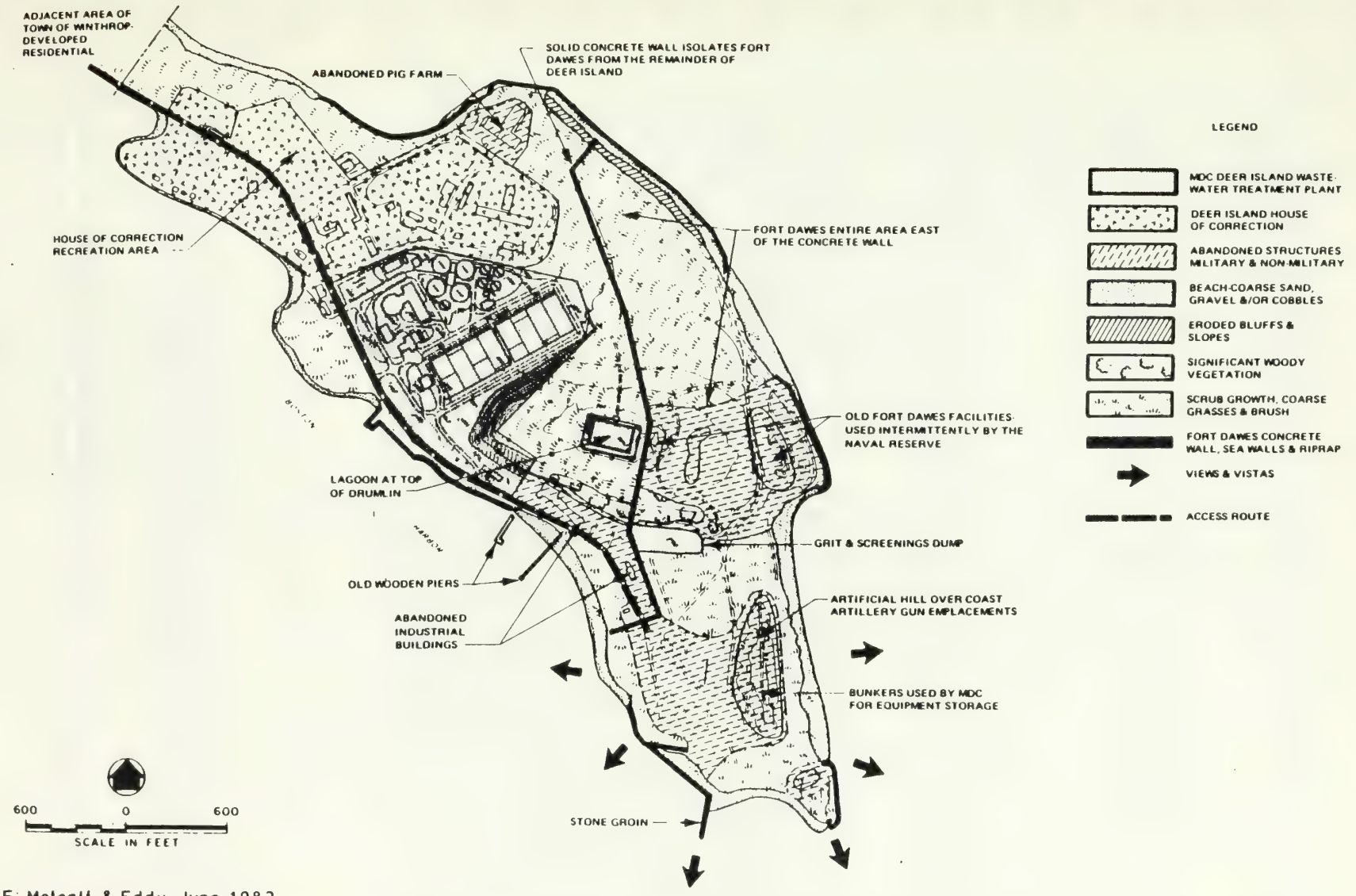
Figure 5.2.5-1 depicts the existing conditions on Deer Island. Deer Island, adjacent to the southern tip of Winthrop, is approximately 200 acres in size. The two active land uses are the Deer Island House of Correction, owned and operated by the City of Boston, and the MWRA's existing 343 mgd primary treatment facility for the North Service area. Combined, these facilities occupy a total of approximately 60 acres toward the landward side of the island. Except for the treatment plant and prison structures, almost all of Deer Island is open space with recreational use limited to prison recreation areas and passive recreational areas used by prison and treatment plant employees. Occasional visitors use the south end of the island for passive recreation.

Deer Island is zoned "B-1, General Business" by the City of Boston. This classification allows all commercial and residential uses, but excludes industrial or other nonconforming uses without a variance. The existing nonconforming uses of the prison and the treatment plant predate the zoning classification.

The Deer Island House of Correction has more than 450 inmates, and more than 4,000 visitors annually. House-to-house searches undertaken in the neighborhood and the use of sirens following prison escapes (20 during 1983) have angered neighborhood residents. Past concerns for the prison's problems and its proximity to residential areas have led to local, state, and federal efforts to relocate this facility. Applicable state law requires that the House of Correction be relocated by 1989.

Although a prison and a sewage pumping station have been located on Deer Island for nearly 100 years, it was after the hurricane of 1936 that these metropolitan uses on Deer Island began to be more closely associated with the Point Shirley neighborhood. Prior to this time, Shirley Gut and its swiftly moving currents physically separated Deer Island from Winthrop. Access was by ferry. Hurricane winds and tides deposited sand and silt that connected the Island to Winthrop. This was consolidated and made into a causeway permanently linking the two areas. Loss of the Gut reduced the flushing action around Deer Island and brought the island into closer association with the Town of Winthrop (even though Deer Island remained a part of the City of Boston).

The Point Shirley and Cottage Hill neighborhoods are the closest communities to Deer Island. They are situated on a narrow peninsula with Point Shirley connected to Deer Island and separated from Winthrop by a causeway. The neighborhoods are predominantly residential with approximately 450 residences and a population of about 1000 people in Point Shirley, and about 1400 residences and approximately 3400 people in Cottage Hill. A majority of the homes, originally built as summer cottages, have been winterized and are used on a year-round basis.



SOURCE: Metcalf & Eddy, June 1982

MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 5.2.5-1
DEER ISLAND EXISTING CONDITIONS

Most major commercial activity in Winthrop is located along the main truck route to Deer Island. Zoning in Point Shirley, Cottage Hill, and throughout much of Winthrop is designated "Residence A, Single Family Use."

Areas surrounding Deer Island can be characterized as residential in Winthrop to the northwest, transportation oriented at Logan International Airport to the west, open/institutional on Long Island and the President Roads shipping channel to the south, and open water (Broad Sound and the Atlantic Ocean) to the north and east.

Visual Character

With an elevation at the summit of 210 ft., the drumlin is the dominant natural feature on Deer Island. Although it has been altered by activities related to the treatment plant and the military, it is still a prominent visual feature, defining and characterizing Deer Island from locations on-shore and in the Harbor.

A visual analysis of the Island was performed by Jung-Brannen Assoc. in 1986 as part of this study. It identified six visual zones within Boston Harbor -- the inner harbor, Dorchester Bay, Quincy Bay, Hingham Bay and two clusters of islands: Gallop, Lovells, George's Island and the Brewsters (Jung-Brannen, 1986). Two major gateways and three minor gateways to the Harbor were evident. Deer Island and Long Island frame the major Atlantic gateway to the outer harbor, while Logan International Airport and Castle Island frame the second major gateway between the inner and outer harbor. Nut and Peddock Islands create a minor gateway between Quincy Bay and Hingham Bay. The other two minor gateways do not affect the MWRA project area.

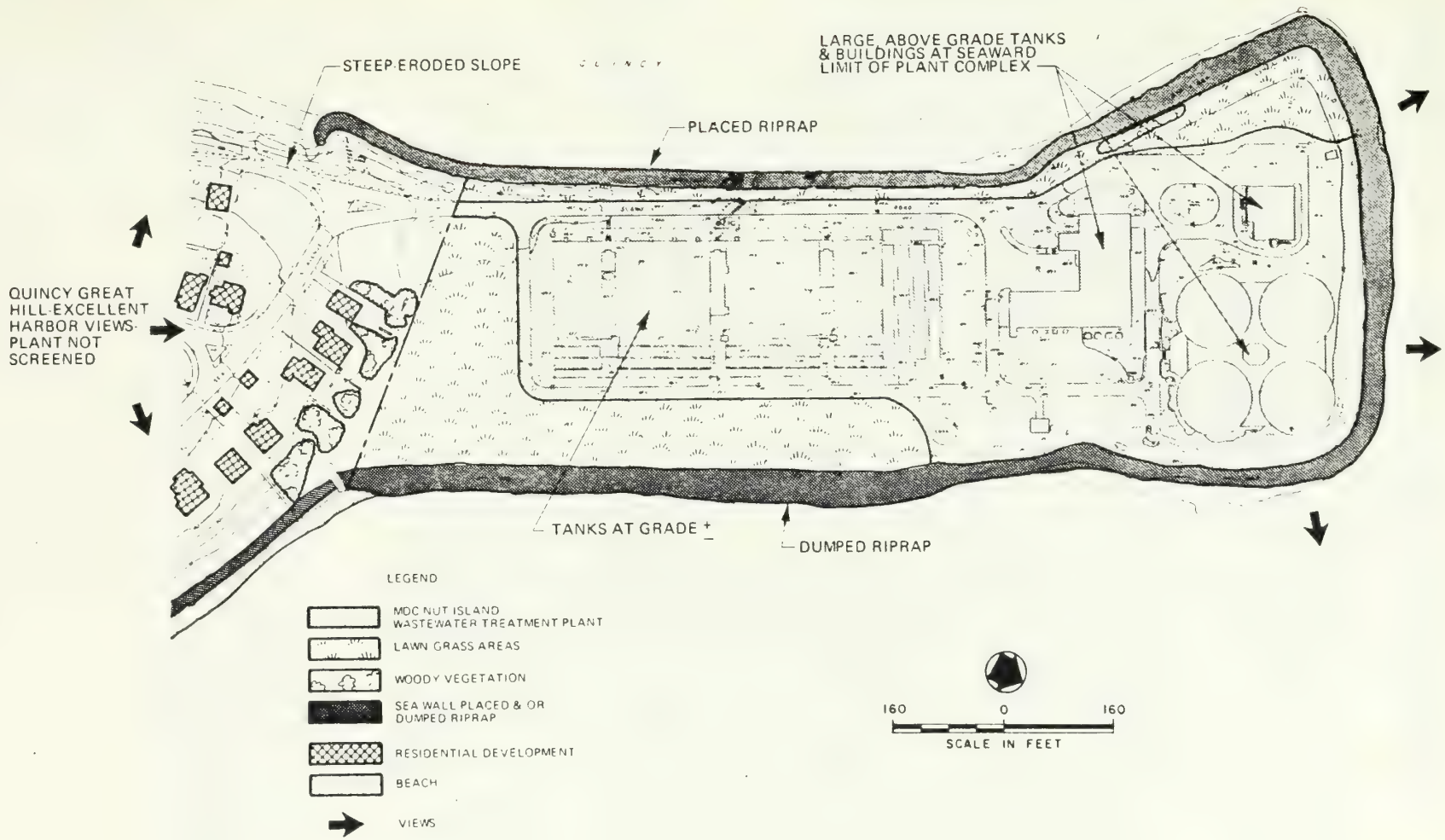
Based upon the identification of landmarks, zones of vision were drawn from the near and distant viewpoint landmarks. It was determined that near views to Deer Island were available from various places in Winthrop, Logan Airport, Castle Island, and the islands to the south, including Long Island. Distant views are available from the office towers of downtown Boston and Back Bay, the JFK Library in Dorchester, from the shores of Nahant, and from the point at Hull High School. From the water, three types of craft have views of the site: commercial ships in the main channels; passenger ferries that follow designated routes; and recreational craft that can view the site from several points.

Nut Island

Land Use

Nut Island is a peninsula located on the southern shore of Boston Harbor. Existing Nut Island topography is flat, with almost its entire 17 acre area lying between elevations 125 and 130 feet. The edge of this flat area is rip-rap which drops off steeply to the intertidal area.

Figure 5.2.5-2 shows the existing conditions at Nut Island. Nut Island is occupied exclusively by structures associated with the primary treatment facility: tanks are situated at the



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FIGURE 5.2.5-2
NUT ISLAND EXISTING CONDITIONS

landward end of the site and major above-grade structures are situated at the seaward limit. The property has been recently rezoned by the City of Quincy as "Open Space."

While the island is entirely open, there is no significant vegetation on Nut Island or on the fill area that connects it to the mainland below Hough's Neck. A majority of the property is either covered with concrete or blacktop. Consequently, the area is only occasionally used for recreation by children during the summer or by parking at the north end, apparently taking advantage of the Harbor view.

Nut Island adjoins the residential neighborhood of Hough's Neck, which is a peninsula forming the southeastern boundary between Quincy and Hingham Bays. Hough's Neck is a densely developed residential area with some commercial development along its main streets. The housing in this area was originally built as summer residences; however, nearly all of the houses have since been converted for year-round use. Hough's Neck contains approximately 180 homes within one mile of the Nut Island treatment plant. The closest homes are only about 300 feet away. Population in Hough's Neck is estimated at approximately 4,000 persons (CE Maguire, 1987).

The chief attractions of the Hough's Neck neighborhood are its waterfront location, access to recreation, and views of the Harbor. Neighborhood commercial uses, including food stores, restaurants, marinas and boat rentals are located along Sea Street, the major access route. Access for boating and fishing is provided by the Quincy Yacht Club and a boat rental business, both on Hingham Bay. (CE Maguire, 1987).

Visual Character

There are approximately 10 dwellings on the eastern shoreline of Hough's Neck on Quincy Great Hill with near views of the treatment facility. For these homes, the treatment plant is a primary focal point in the view and imposes a significant industrial character on an otherwise residential area.

On the shoreline west of Hough's Neck, approximately 20 houses are located at or near sea level and eight more have northwesterly views from 60 to 90 ft above sea level. Northeasterly views from the lower elevations are blocked by the treatment facility. The plant tends to blend in, however, with the general developed character of Hough's Neck, as one continues to look toward the east. The majority of the Harbor view from these locations is unaffected by the existing treatment plant. (Metcalf & Eddy, 1982).

The operation of the wastewater treatment plant on Nut Island has been a source of problems for residents of Hough's Neck. The discharge of unscreened and untreated sewage from the plant is a recurring problem for local residents and those using the shoreline and Harbor areas around the treatment plant. Odors emanating from the plant are not a problem, at present. However, the temporary use of emergency generators has led to noise complaints from nearby residents in the past.

5.2.6 TRAFFIC

Deer Island

Land access to Deer Island is by a causeway that connects the island to the mainland. The island is within the corporate boundary of Boston; however, access to the causeway is by local roads passing through the Town of Winthrop. Figure 5.2.6-1 shows a map of Winthrop. Route 145 does not pass through the central part of town where the downtown business district and town hall are located, but circumnavigates it. The route provides general access from the north and west, over Bennington Street, Saratoga Street, Main Street, Pleasant Street, Washington Avenue, Veterans Road, Winthrop Shore Drive, Crest Avenue, and Revere Street. On the western side, the crossing of Belle Isle Inlet leads to East Boston. On the northern side, a similar crossing leads to the town of Revere.

A truck route has been defined and is posted, requiring that trucks moving into and out of Winthrop, and to Deer Island and back, use Bennington Street, Saratoga Street, Main Street, Revere Street, Shirley Street, Veterans Road, Washington Avenue, and Shirley Street. This route also avoids passage through the town center. Current truck movements over the defined route often occur with police escort.

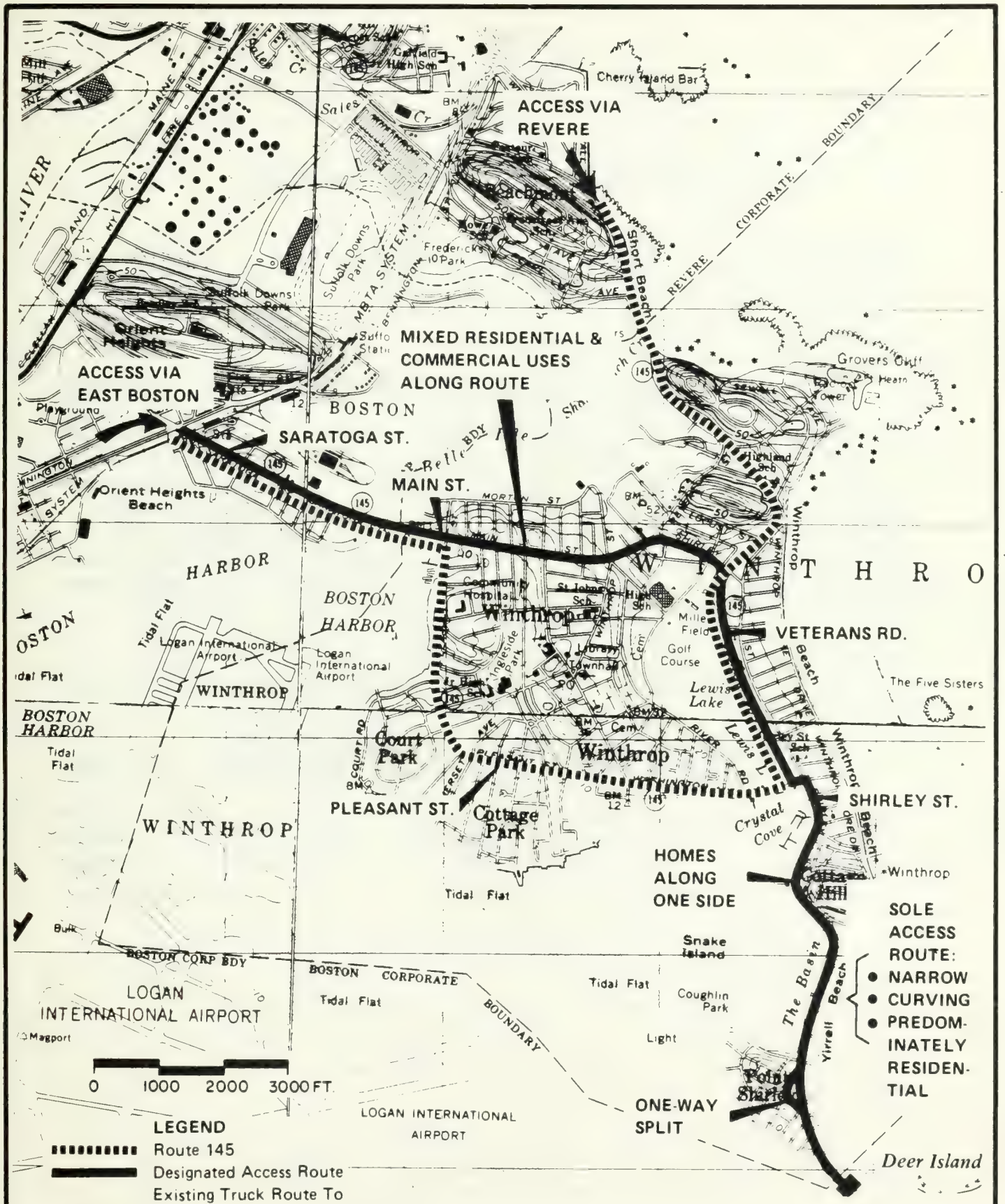
Restrictions affecting use of the truck route include load limits on the bridge carrying Saratoga Street over the MBTA Blue Line and the Belle Isle Bridge. Saratoga Street bridge is currently limited to 2-axle trucks that are 13 tons or less, 3-axle trucks that are 20 tons or less, and 5-axle trucks that are 33 tons or less. This is temporary posting because of the jersey barriers currently limiting the number of lanes of traffic allowed on the bridge and temporary shoring.

The Belle Isle Bridge has not been posted, in view of the severe impact that existing posting (18, 18, and 21) would have on commerce. During design, structural analysis of the bridge should be performed to ensure that the bridge is not adversely affected by loadings in excess of current ratings.

Curbside parking is allowed along Main Street, Revere Street, and Shirley Street. The entire route supports two-way traffic flow; no one-way routing has been allowed, to achieve higher throughput.

Local roadways elsewhere in Winthrop are fairly narrow, and there are no restrictions on curbside parking. Observed vehicular movements are dispersed and irregular. Only rarely is traffic movement delayed while a moving vehicle enters the opposing lane to avoid a parking vehicle occupying the moving lane.

The traffic capacity of the predominantly two-lane local urban streets in the vicinity of Deer Island is approximately 1600 vehicles per hour (total for both directions). Present traffic flows on local roads are in the range of 150 to 625 per hour (total for both directions). Traffic volume data for 1984 and 1985 are shown in Table 5.2.6-1. While local roads have more



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FIGURE 5.2.6-1
ACCESS ROADWAYS TO DEER ISLAND

TABLE 5.2.6-1

WINTHROP TRAFFIC FLOW DATA, 1984 AND 1985

1984 Data (EPA, 1984)

Location	2-Way ADT	2-Way DHV	2-Way AM Peak Hr.	2-Way PM Peak Hr.
Washington St.	7,700	625		
Veterans Rd.	2,700	225		
Shirley St.				
S. of Washington	6,700	525		
N. of Washington	1,900	150		
Revere & Cross	4,700	370	260	358
Pontos & Petrel	5,300	420	272	343

1985 Data (MWRA, 1985)

	One-Way ADT		One-Way AM Peak		One-Way PM Peak	
Location	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB
Main St.	6,668	6,349	365	577	614	405
Veterans Rd.	1,194	1,715	81	97	96	146
Shirley St.						
S. of Washington					285	324

adequate excess capacity to accommodate additional construction traffic, there is often congestion at certain intersections during the morning and evening rush hours. Calculations performed in the Final Environmental Impact Report, based on the U.S. Department of Transportation Level of Service Criteria, indicate that long delays can be expected during the evening peak hour traffic at several intersections along the access route to Deer Island (MWRA, 1987).

Eight intersections have been identified that could be affected by additional traffic movements to and from Deer Island. These intersections, and any existing controls are listed below.

1. Bennington and Saratoga Streets - phased signal
2. Main and Pleasant Streets - phased signal
3. Main, Winthrop and Revere Streets - phased signal (blinking)
4. Main and Herman Streets - phased signal
5. Revere and Shirley Streets - phased signal (blinking)
6. Shirley Street and Veterans Roads - blinking signal
7. Veterans Road and Washington Avenue - no signal
8. Washington Avenue and Shirley Street - no signal

The intersections were analyzed using methods contained in the 1985 Highway Capacity Manual. Existing conditions analysis for signalized and unsignalized intersections are presented in Table 5.2.6-2 and Table 5.2.6-3 respectively. The methodology used in this analysis is described in detail in Appendix K of Volume III. The table indicates that in either direction, traffic on major streets is generally unaffected by vehicles executing left turns. The exception is the westbound approach at the Main, Revere, and Winthrop Streets intersection. This approach is at service level B. Service levels on minor streets range from A to E. Service level criteria for signalized and unsignalized intersections are presented in Tables 5.2.6-4 and 5.2.6-5 respectively.

Observations of general traffic conditions in Winthrop have shown that vehicular speeds are between 20 and 30 mph and appear to be a matter of local habit and preference rather than a result of deliberate enforcement policies. Observed speeds over the entire truck route are moderate, serving to reduce congestion and preserve saftey along the route.

Accident history data for the intersections, taken over a six-year period, were obtained from the Massachusetts Department of Public Works. Table 5.2.6-6 provides a summary of these data for the ten intersections.

The data show that a majority of accidents involve two vehicles in traffic and either a rear or an angle collision. Injuries occurred in 81 out of the 373 accidents. There were no fatal accidents.

The intersections at Bennington and Saratoga Streets and Main and Pleasant Streets show a combined total of 162 accidents. These two intersections serve as main entry points into Winthrop. Three additional intersections that show a relatively high number of accidents are

TABLE 5.2.6-2

SIGNALIZED INTERSECTION ANALYSIS RESULTS

Intersection	Peak Hour Volume (vhcls)	Capacity (vhcls)	Crtcl V/C	Cycle Length (secs)	Overall Srvc Lvl	Avg Delay Per Vhcl (secs)
Main/Herman	1145	2215	.61	78	B	5.1
Main/Pleasant	2147	3579	.73	78	B	13.5
Bennington/ Saratoga	2461	4576	.63	111	C	23.5

TABLE 5.2.6-3

UNSIGNALIZED INTERSECTION ANALYSIS RESULTS

Intersection[1]	Major Street						Minor Street					
	Drctn	Rsrv Cpcty	Srvc Lvl	Drctn	Rsrv Cpcty	Srvc Lvl	Drctn	Rsrv Cpcty	Srvc Lvl	Drctn	Rsrv Cpcty	Srvc Lvl
Washington Avenue/ Shirley Street[1]	EB	960	A				NB	277	C	SB	595	A
Washington Avenue/ Veterans Road	WB	798	A				SB	246	C			
Veterans Road/ Shirley Street	NB	870	A	SB	961	A	EB	285	C	WB	518	A
Revere Street/ Shirley Street	WB	597	A				NB	13	E			
Main, Revere/ Winthrop, Main	EB	904	A	WB	313	B	NB	56	E	NB	242	C

[1] Major Street/Minor Street

TABLE 5.2.6-4

SIGNALIZED INTERSECTION SERVICE LEVEL CRITERIA

Level of Service	Stopped Delay per Vehicle (secs)
A	0.0 to 05.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	60.1 and greater

TABLE 5.2.6-5

UNSIGNALIZED INTERSECTION SERVICE LEVEL CRITERIA

Reserve Capacity (pssngr cars/pr hr)	Level of Service	Expected Delay to Minor Street Traffic
400 and greater	A	Little or no delay
300-399	B	Short traffic delays
200-299	C	Average traffic delays
100-199	D	Long traffic delays
0-99	E	Very long traffic delays
*	F	*

*When demand exceeds the capacity of the lane, extreme delays will be encountered with queuing, which may cause severe congestion affecting other traffic movements in the intersection.

TABLE 5.2.6-6

ACCIDENT HISTORY SUMMARY

Intersection	Total Accdnts	Accdnts W/ Injry	Accdnts W/ Fatal	Vhcl Invlvd Per Accident 1	2	3	>4	Injury Nmbr Per Accident 1	2	3	>4	Motor Vhcl Collision with: Ped	Mvng Vhcl	Prkd Vhcl	Objct Off-rd	Objct By-rd	Othr	Collision Type Rear	Angl	Head	Othr	Stp Sgn	Traffic Control Type Wrng Sgn	Sgnl	No Sgnl	No Cntrl	Othr
Bennington/Saratoga	101	21	0	7	83	10	1	14	5	2	0	4	71	16	2	1	7	33	47	2	19	3	0	61	1	35	1
Main/Pleasant	61	10	0	2	54	1	2	6	4	0	0	0	53	3	1	2	2	28	21	3	9	3	0	37	0	20	1
Main/Hermon	13	4	0	3	7	1	2	2	1	1	0	1	7	1	0	1	3	3	6	1	3	1	0	7	0	5	0
Main/Revere/Winthrop	47	9	0	10	35	1	1	7	2	0	0	2	28	7	2	1	7	13	23	1	10	1	3	22	0	19	5
Revere/Shirley	26	8	0	4	21	0	1	8	0	0	0	2	18	3	2	0	1	5	14	1	6	4	2	10	0	10	2
Shirley/Veterans	39	9	0	0	35	3	1	6	3	0	0	0	32	4	0	0	3	4	28	1	6	20	0	9	0	10	0
Veterans/Washington	5	2	0	2	2	0	1	2	0	0	0	1	0	3	0	0	1	2	1	0	2	0	0	0	0	5	0
Washington/Shirley	26	7	0	2	23	1	0	6	0	1	0	1	15	6	1	0	3	5	19	0	2	3	0	0	0	22	1
Veterans/Winthrp Shr	4	0	0	0	4	0	0	0	0	0	0	0	3	0	1	0	0	0	3	0	1	3	0	0	0	1	0
Crest/Revere/Highland	51	11	0	3	45	3	0	9	2	0	0	0	41	3	1	1	5	14	24	4	9	27	0	0	0	23	1
Totals	373	81	0	33	309	20	9	60	17	4	0	11	268	46	10	6	32	107	186	13	67	65	5	146	1	150	11

*Accident Data is taken from Massachusetts Department of Public Works computer printouts for 1 January 1975-31 December 1980 and 1 January 1983-31 December 1983.

at Main Street, Revere Street, and Winthrop Avenue; Shirley Street and Veterans Avenue; and Revere Street and Shirley Street. All three intersections are currently controlled by flashing signals. Of the unsignalized intersections, the interesection of Shirley Street and Washington Avenue, which has commercial businesses on each corner, shows the highest accident rate, with 26 accidents occuring within the six-year period.

Nut Island

Access to Nut Island is via Sea Street from the Southern Artery (Route 3A), as shown in Figure 5.2.6-2. Sea Street is a two-way four-lane roadway that connects Hough's Neck to the City of Quincy via Adams Shore. All traffic to and from Nut Island must use local roads passing through Quincy, Braintree and Weymouth.

From Sea Street, Sea Avenue provides access to Nut Island over Quincy Great Hill. The Avenue ascends and descends the hill at a steep grade. Adjacent land is densely developed for residential use. A variety of commercial activities are located nearby and parking is allowed on the street.

Table 5.2.6-7 presents 1983 Average Daily Traffic Volumes (ADT) and Design Hour Volumes for locations where the Massachusetts Department of Public Works has obtained traffic counts. The table originally appeared in the supplemental draft environmental impact report (DEIR) on Siting of Wastewater Treatment Facilities for Boston Harbor.

The two-lane, two-way portion of Sea Street has a capacity of 1,600 vehicles for both directions of travel. The existing traffic through this section of the access route is estimated at only 600 vehicles per hour, indicating more than sufficient capacity on Sea Street for additional traffic. Capacity and level of service data are not available for intersections along the Nut Island access route.

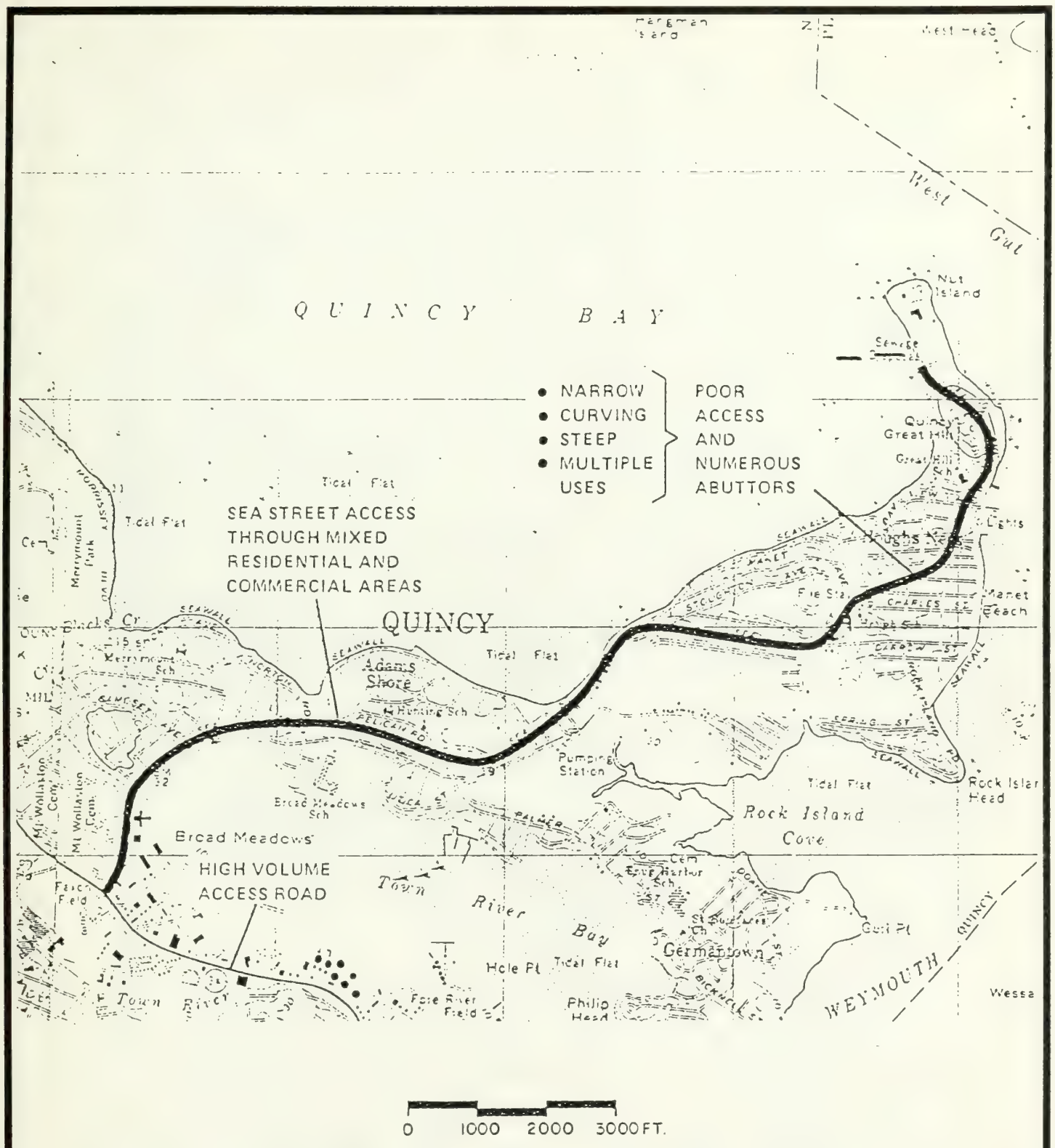
Construction impacts to Quincy and the surrounding area have been addressed in the Final Environmental Impact Report for On-Island and On-Shore Water Transportation Facilities (1987). Included in these studies are the traffic assessments of Sea Street and Sea Avenue.

Section 5.2.6 References

Massachusetts Water Resources Authority (MWRA). 1987. Facilities Plan and Environmental Information Document - Volume 7, On-Island Water Transportation Facilities. October, 1987, p. 2-17.

5.2.7 NOISE

Noise associated with the construction and operation of the new Deer Island secondary wastewater treatment plant, and at headworks facilities on Nut Island, has the potential for affecting portions of the Town of Winthrop. To minimize noise impact, noise control requirements will be incorporated into the treatment plant facilities planning process through



FROM: C.E. Maguire, 1987

MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 5.2.6-2
ACCESS ROADWAYS TO NUT ISLAND

TABLE 5.2.6-7

TRAFFIC COUNT RECORDS IN THE VICINITY OF NUT ISLAND

Location	Lanes	ADT	Two-Way* DHV	One-Way DHV	One-Way Capacity*
Quincy Shore Drive	4	24,150	1,950	1,365	2,800
Sea St., west of Quincy Shore Drive	4	34,300	2,750	1,925	2,800
Sea St., east of Quincy Shore Drive	4	20,400	1,650	1,115	2,800
Sea St., east of Rockland St. - Winthrop St.	2	7,350	600	**	***1,600
Southern Artery south at Sea St.	4	32,700	2,600	1,820	2,800
Sea St. at Southern Artery	4+	36,850	2,950	2,065	2,800

* Source: Highway Capacity Manual, 1965.
** Use Two-Way DHV figure for comparison
***Two-Way Capacity

Data from EPA, 1984.

the use of noise evaluation criteria. These criteria will be employed to judge the effectiveness and acceptability of noise controlling alternatives as they apply to wastewater treatment equipment, site planning, and construction. The existing regulatory and environmental factors that constitute the basis for developing the noise evaluation criteria are summarized in this section.

Regulatory criteria that address noise control, as well as assessments of potential impacts, rely on evaluations of baseline noise levels for judging the magnitude and acceptability of incremental noise changes. Several baseline noise surveys have previously been made within the Point Shirley study area. These surveys sampled ambient noise for periods of a few minutes up to 24 hours.

This section characterizes existing noise within the study areas, and describes a more extensive study that was conducted during this facilities plan to provide a firm statistical basis for the development of recommended noise criteria for Deer Island. The results of this and previous surveys, and recommendations for construction and operational noise criteria, are summarized herein.

Regulations and Guidelines

The assessment of noise impact involves determining both the increase in ambient noise and compliance with appropriate regulations. Three noise regulations are potentially applicable to the Deer Island site. These are the City of Boston Noise Regulations, the Massachusetts Department of Environmental Quality Engineeering (DEQE) guidelines, and U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) standards. These regulations are summarized below.

The City of Boston's noise regulations address various sources of noise and set specific noise limits for the transmission of sound between properties of the same and different zoning. The allowable noise transmitted to a residential zone during the daytime hours of 0700 to 1800 (7:00 a.m. to 6:00 p.m.) is 60 dBA. A 50 dBA level is allowable during the remaining nighttime hours. The maximum noise allowed to be transmitted to an industrial site is 70 dBA. The code also has corresponding octave band level requirements.

The Boston noise code limits construction noise at the residential and institutional property lines to an L10 (the level exceeded 10 percent of the time) of 75 dBA and a maximum level of 86 dBA. The allowable L10 for recreational land is 80 dBA. Construction is not permitted at night or on weekends unless the construction noise level at the residential property line does not exceed 50 dBA.

The State of Massachusetts Department of Environmental Quality Engineering (DEQE) guidelines on noise allow a new facility to increase the ambient noise a maximum of 10 dBA over the existing L90 ambient noise, i.e. the level exceeded 90 percent of the time. The L90 levels to be used have been based on sorting daytime and nighttime measurements, to yield daytime and nighttime criteria. The DEQE guidelines also prohibit the emission of a pure tone from noise sources. A

pure tone is defined as occurring when the level in one octave band exceeds the level in the two adjacent octave bands by 3 dB or more.

All equipment on the site will be required to conform to the OSHA requirements on noise exposure. These regulations allow an equivalent 8-hour exposure of 90 dBA for the protection of employee hearing. Where equipment cannot be purchased to meet OSHA noise exposure requirements, noise mitigation must be added as required.

Previous Ambient Sound Level Surveys

At least five previous ambient sound level surveys associated with the Deer Island treatment facilities have been conducted in the Deer Island area. These surveys are summarized in Table 5.2.7-1. The surveys collected statistical sound level samples of a few minutes to an hour in duration, and in one instance, 24 hours. Measurements were usually collected at several locations. These measurements were used for making preliminary assessments of anticipated noise impact for the facility.

However, as part of secondary treatment facilities planning and environmental reviews, a more extensive data base was desired. Ambient noise is a statistical quantity that not only varies diurnally, but also from day to day. Both the perceived noise impact and the allowable level as required by the DEQE are based on an assessment of the existing ambient sound level. A sampling program which continuously monitored ambient sound levels 24 hours a day for a total of 17 days was conducted. This large sample of ambient sound levels provides a broad base for assessing the existing ambient levels.

Two ambient sound level surveys have been conducted in the Nut Island treatment plant area. Data from these surveys have been used to assess the noise impacts expected from the construction and operation of the new facility, as described later in this section.

Ambient Sound Level Survey

For this study, an ambient sound level survey was conducted at Point Shirley, in the Town of Winthrop, as the nearest area potentially impacted by facility construction and operation noise. The goals of the survey were to:

1) Establish the spatial variation in the ambient sound levels throughout Point Shirley.

2) Establish the diurnal variation in the sound levels.

3) Determine the temporal variability of sound levels from day to day.

4) Identify the sources of noise controlling these levels.

Measurement Locations and Methodologies

A preliminary inspection of the study area indicated that the primary noise sources were Logan

TABLE 5.2.7-1

SUMMARY OF PREVIOUS AMBIENT SOUND LEVEL SURVEYS CONDUCTED IN WINTHROP FOR THE WASTEWATER TREATMENT PLANT

CONDUCTED BY	DATE	REPORTED IN
Metcalf and Eddy	1982	Site Options Study, Vol. II 1982.
Havens and Emerson	4-3-84	Supplemental Draft Environmental Impact Statement/Report on Siting of Wastewater Treatment Facilities for Boston Harbor. Vol. 2.
Thibault and Bubly Associates	6-12-85	Noise Analysis (To EPA).
Cavanaugh Tocci Associates	9-11-85 9-25-85	Supplemental Draft Environmental Impact Statement/Report on Siting of Wastewater Treatment Facilities for Boston Harbor. Vol. 2, Appendix.
C.E. Maguire, Inc.	7-1-86	Notice of Project Change, On-Island Water Transportation Facilities, 7-31-86.

Airport, traffic on Tafts Street and other local roads, surf noise from the beaches, and occasionally the existing treatment plant. Previous studies also indicated that the Nordberg diesel drives on the existing wastewater pumps were sometimes audible. These previous studies also assessed the sound levels throughout Winthrop and concluded that the mainland portion of Winthrop had nighttime L90 levels in the 34 to 40 dBA range, whereas Point Shirley was slightly louder, in the 40-43 dBA range. Since the distance to the other parts of Winthrop are greater, the criteria selected for Point Shirley will also serve as conservative criteria for the balance of Winthrop.

Measurement locations were selected to provide data on each of the sources discussed in the previous paragraph, as well as to be spatially distributed across Point Shirley. A map of the locations is given in Figure 5.2.7-1. All of the locations except No. 1 have line-of-sight shielding by houses from the airport and surf. Location 1 was shielded by a house from the diesel pump station. Locations 2 and 3 had line-of-sight visibility to the diesel pump station.

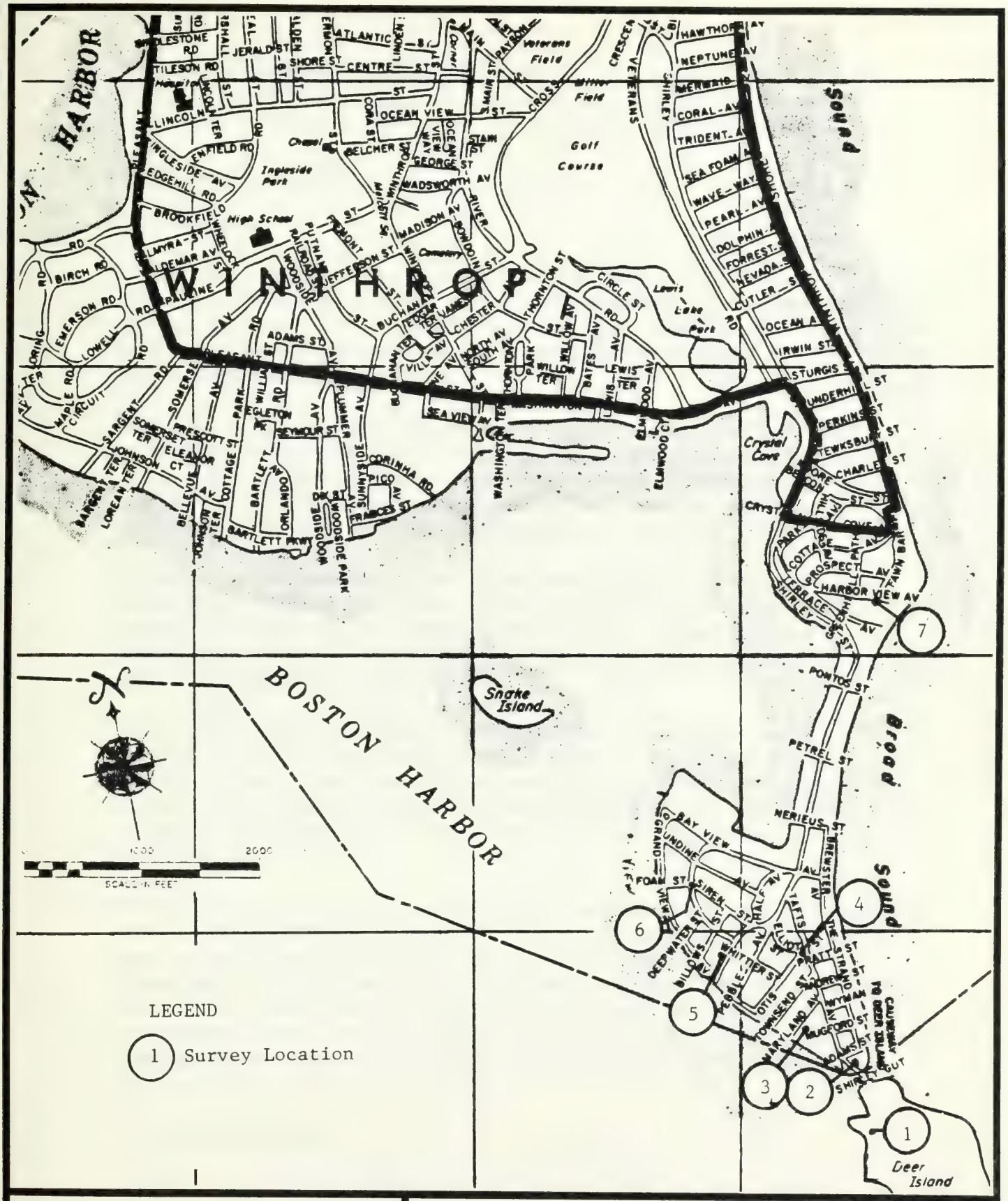
Two types of noise survey methodologies were utilized which, when used in conjunction with each other, provide a complete description of the spatial and temporal variation in sound levels. The first type consisted of the continuous statistical monitoring of sound level sequentially at Locations 1 and 3, shown in Figure 5.2.7-1. A total of 17 data days were taken sequentially at these locations. Locations close to the plant were selected for the continuous monitors because the potential for noise impact is the greatest close to the site. The monitor was periodically calibrated throughout the survey.

The second type of survey was staffed, and measurements were taken with portable instrumentation. During these surveys, 10-minute statistical samples of sound level data were always taken, and on three out of five of the surveys, residual octave band measurements were also taken. The staffed surveys enable a number of locations to be measured in a relatively brief period of time along with observations of the sources of noise. The staffed surveys were conducted during 2- to 3-hour periods during the day and night at Locations 1, 2, 4, 5, 6, and 7. The staffed survey results are given in Appendix C, Tables C-1 through C-5.

Instrumentation

Two types of instruments were used for measuring the ambient sound levels. A Larson-Davis 800 Noise Analyzer and a Bruel and Kjaer 2215 sound level meter were used manually to measure residual octave band sound pressure levels and A-weighted sound level statistics. The residual octave band measurements are taken in the absence of transient noise such as passing vehicles and aircraft landings. Ten-minute statistical samples of the A-Weighted sound level were taken by reading the meter every 10 seconds and preparing a histogram of the data. All manual measurements were taken with local winds less than 10 mph.

The second type of instrument used was a Larson-Davis 700 Noise Dosimeter, which continually



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FIGURE 5.2.7-1
AMBIENT SOUND LEVEL SURVEY MEASUREMENT POSITIONS, WINTHROP, MASSACHUSETTS, SEPTEMBER 1986

measures and statistically analyzes the variable ambient noise. The device was programmed to provide hourly statistics including the L10, L50, and L90 values. The L90 value typically represents the residual or background level that occurs when transient noise is absent.

Survey Results and Discussion

Manually-Collected Data

The manually-collected data discussed above for Point Shirley is presented in Appendix D of Volume III, Tables D-1 through D-5. Most of the L90 sound level data taken some distance from the water (Locations 4, 5, and 6) were determined to be in the 42-47 dBA range. Measurements taken from locations that are more exposed to surf noise, such as Locations 1, 2, 3, and 7, were sometimes several decibels higher.

During the day and evening, the quiet intervals between aircraft takeoff and landing were observed to be infrequent and brief. However, after the hours of approximately 2300 to 2400 (11:00 p.m. to midnight), takeoffs and landings became infrequent and the residual levels appeared to be controlled by surface aircraft operations at Logan Airport, surf noise, and occasionally the Nordberg diesels of the treatment plant wastewater pumps.

In general, the more sheltered locations, i.e. those away from the shore, were 5 or 6 dBA quieter than those near the water because they were partially shielded from Logan ground operations, surf, and occasional diesel noise. This was directly observed in the field by measuring noise primarily from surface aircraft operations, and then moving behind a house to block the line of sight to the airport.

The pump station diesels were inaudible at all locations when the winds were northerly. This is because the vertical gradient in wind speed tends to raise the upwind sound wave off the ground and creates a shadow zone. However, when the winds had a southerly component, i.e. from the direction of the diesels, the diesels were occasionally audible at one or two measurement locations that varied from survey to survey. Diesel audibility is indicated in Appendix D of Volume III, Tables D-1 to D-5.

When audible, the diesel sound varied in an irregular, pulsing manner caused by multiple diesel units operating at slightly different speeds. Most of the diesel noise was in the 63 Hz octave band corresponding to the cylinder firing rate. At one of the measurement locations the diesels caused a 4 dBA variation in the sound level on "fast" response. The level in the 63 Hz band on "fast" response varied from 5-10 dB. On "fast" response the meter's response time is reduced and the meter becomes very sensitive to rapid changes in sound level. All other measurements were taken on "slow" response as is standard practice for community noise measurements.

Continuous-Monitor Data

A tabulation of the data from the continuous monitor used first at Location 1 and then at

Location 3 is given in Appendix D in Volume III. These data describe the diurnal variation in sound level for 13 days at Location 1, and 5 days at Location 3. The data from the two locations are similar and are analyzed together.

The L90 data were divided into meaningful time periods and sorted to examine the group statistics. The L90 sound levels for the nighttime period of 2300 to 0600 (11:00 p.m. to 6:00 a.m.) were grouped together and sorted to determine their percentiles of exceedence. During this period of time, it is likely that a significant percentage of the population would be sleeping.

This analysis indicates that during 50 percent of the time, the nighttime L90 values were greater than 45 dBA, indicating that 45 dBA is a typical value for the nighttime L90 sound level. The 90 percentile value of the L90 sound level at that location is 39 dB. The lowest hourly L90 measured was 35 dBA at Location 1.

A similar analysis was performed for the daytime hours of 0700 to 1800 (7:00 a.m. to 6:00 p.m.). This time period includes the most common periods of construction. The quietest hour during this period was at 41 dBA. However, 90 percent of the time the L90 levels were in excess of 45 dBA, and 50 percent of the time they exceeded 51 dBA. These measurements generally agree with the previous shorter-term assessments on noise on Point Shirley.

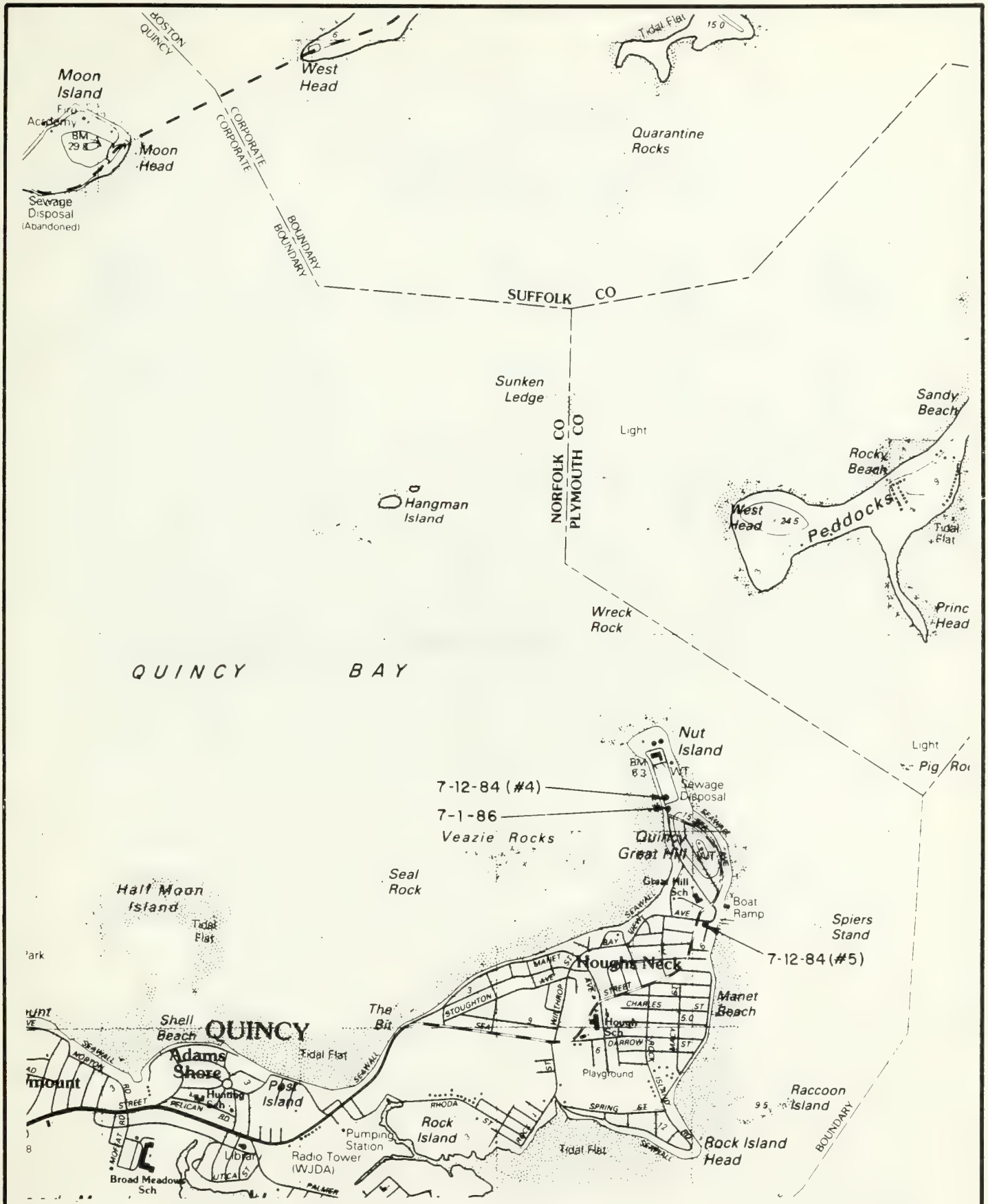
As indicated previously, two ambient sound level surveys have been conducted in the vicinity of Nut Island. The first noise survey was conducted on July 12, 1984, by CE Maguire. This survey was previously reported in the SDEIR. The second survey was also conducted by CE Maguire and reported in their pile driving analysis. A map of the ambient measurement locations for both surveys is given in Figure 5.2.7-2 and a summary of the data is tabulated in Tables 5.2.7-2 and 5.2.7-3.

The L90 sound levels from the July, 1984 survey were 52 and 54 at measurement locations 4 and 5. The L90 sound level was again measured on July 1, 1986, in the morning and in the afternoon at 49 and 47 dBA, respectively. The sampling period was 20 minutes.

Recommended Criteria

Two noise assessment criteria are required: one for assessing the noise from daytime activities such as construction and operation of the facility; and one for assessing the nighttime operation of the facility. These criteria differ because the ambient sound level changes from day to night.

The nighttime L90 sound level is generally used to assess nighttime noise impact. However, when a large sample of L90 data is collected, it becomes necessary to statistically select a representative L90 value. In order to be conservative, the 90 percentile value of the nighttime L90 values was selected for assessing nighttime noise impact. This value is 39 dBA. In other words, 90 percent of the nighttime L90 values exceed 39 dBA.



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TABLE 5.2.7-2

AMBIENT NOISE LEVELS IN THE VICINITY OF NUT ISLAND, 1986[1]

Project Location	Measured Statistic	Start Time	Sound Level	Start Time
Nut Island	L90	10:38 am	49	--
	L10		53	--
	Leq[2]		52	--
	L90	2:45 pm	47	1:30 pm
	L10		55	
	Leq		56	

[1] From pile driving analysis, C.E. Maguire to MWRA, 7-14-86
[2] Energy average sound level

TABLE 5.2.7-3

AMBIENT NOISE LEVELS IN THE VICINITY OF NUT ISLAND[1]

SITE	L10	L50	L90	Leq
1. Houghs Neck - Nut Island Gate	56	55	54	55
2. Houghs Neck - Sea St.	59	54	52	56
3. Adams, Shore, Quincy - Sea St.	68	64	58	65

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[1] A-weighted sound pressure levels, recorded by CE Maguire, Inc. during mid-morning and afternoon of 7/12/84

It is recommended that 39 dBA be used to assess the maximum nighttime noise impact at the property line. Other portions of Winthrop are much further in distance from Deer Island, and will receive adequate protection with this same criterion. This would also result in a DEQE requirement of 49 dBA for the allowable 10 dBA above ambient stipulated in Massachusetts DEQE Regulation 10 of the Air Pollution Regulations. It is not suggested that a 49 dBA level is the design goal, but rather that this level is a legal requirement that the site must, and will, meet as a maximum sound level for nighttime operational noise.

In a similar manner, the criterion for assessing daytime noise impact was determined to be 45 dBA. Since the lowest ambient noise levels occur during the middle of the day and the middle of the night, the maximum impact assessment criteria remain essentially the same during the evening as during the day.

The daytime ambient L90 sound levels taken on Nut Island ranged from 47 to 54 dBA. The quietest of these measurements, the 47 dBA collected in July, 1986, has been used as he ambient sound level criterion for assessing daytime construction noise impact at Nut Island. The continuous operation noise is expected to be sufficiently low so as not to cause an impact. The 47 dBA daytime criterion for Nut Island is very similar to the 45 dBA criterion developed for Deer Island. Nighttime noise measurements have not been reported for Nut Island; for these analyses, a nighttime ambient sound level of approximately 35 dBA has been assumed, based on typical suburban residential areas (EPA, 1974).

In summary, the ambient sound levels (L90) for assessing maximum nighttime and daytime noise impact in the Point Shirley area are 39 and 45 dBA, respectively, as shown in Table 5.2.7-4. Predicted construction and operation noise will be compared with these levels in future analyses to determine the need for noise mitigation. The DEQE level not to be exceeded for constant nighttime operation noise is 49 dBA.

5.2.8 TERRESTRIAL AND AQUATIC ECOLOGY

Deer Island

Descriptive information for Deer Island was derived from a review of literature pertaining to the Island and from site visits. Literature reviewed is listed in the references and as specific credits given in the text. Site visits were made by Stone & Webster ecologists in 1976 and again in 1986.

Site Conditions

Deer Island is a large island of about 203 acres, dominated by a large grass covered drumlin over 100 feet high (Figure 5.2.5-1). This drumlin, like many of the islands in the Harbor, is a geological formation resulting from the accumulation of till, clay, and other materials flushed from beneath the ice sheets of 10,000 years ago. Prior to European settlement, the island probably had a community of deciduous forest, with stands of pines also common (Metcalf & Eddy, 1982). Because of the relatively isolated nature of the island site and its exposure to wind

TABLE 5.2.7-4

SUMMARY OF RESIDUAL SOUND LEVELS, POINT SHIRLEY, TOWN OF WINTHROP

	L90
Daytime 0700-1800 (7:00 a.m. - 6:00 p.m.)	45 dBA
Nighttime 2300-0600 (11:00 p.m. - 6:00 a.m.)	39 dBA

	Criteria
DEQE nighttime operation noise limit, no pure tone	49 dBA
DEQE daytime operation noise limit, no pure tone	55 dBA
OSHA on-site 8 hour exposure limit	90 dBA

and sea salt, any change in the nature of the ecosystem takes a long time to repair itself. Thus, the historical land uses of the site have drastically altered the native vegetation. The present conditions tend to favor communities which form as a fire subclimax (Metcalf & Eddy, 1982). These conditions include:

- o Topography that favors rapid drying
- o Regeneration from undamaged underground plant parts
- o Porous soil
- o Seeds enclosed within fire resistant woody fruits.

Flora

A majority of the present day site is either used for urban (commercial/institutional) activities or is covered with a scrub growth of coarse grasses and brush (Figure 5.2.5-1). The northwest portions of the island are primarily occupied by the existing waste treatment plant and are vegetated, if at all, by scattered grasses and forbs.

Scrub areas along the western side of the island to the south of the sewage treatment plant are primarily old fields dominated by ragweed (Ambrosia artemisifolia). In the low, damp areas, ragweed exceeds 1.5 meters in height. Wild carrot (Daucus carota), chicory (Cichorium intybus), and goldenrod (Solidago spp.) are also abundant. Along the concrete wall, field bindweed (Convolvulus arvensis), common tansy (Tanacetum vulgare), dwarf cinquefoil (Potentilla canadensis), snowy campion (Silene nivea) and bittersweet (Solanum dulcamara) are common.

North-northwest of the Old Pumping Station, the slope rises steeply. The growth in this area is approximately one meter high and dominated by grasses. Ragweed, wild carrot, and milkweed are found at the base of the slope. The walkways around the buildings of the pumping station are overgrown with numerous other forbs.

The slope above the pumping station is an abandoned orchard, dominated by apple (Pyrus sp.), black cherry (Prunus serotina), and staghorn sumac (Rhus typhina). On the central and southern sections of the island is an old field dominated by unidentified grass species (Gramineae). Rabbit's-foot clover (Trifolium arvense), daisy fleabane (Erigeron sp.), common burdock (Arctium minus), milkweed (Asclepias sp.) and bouncing bet (Saponaria officinalis) were also present. This area also contains scattered clumps of trees of diverse mixtures including black cherry, Indian bean (Catulpa sp.), quaking aspen (Populus tremuloides), cottonwood (Populus deltoides), sugar maple (Acer sacchrum) and others.

To the east of the Fort Dawes concrete wall, the island is primarily grassland. The area contains scattered shrubs such as bayberry (Myrica pensylvanica), in occasional clumps with giant reed (Phragmites sp.) in the low areas.

Fauna

The varied nature of the site presents an equally varied habitat for wildlife species. On the

west slope of the drumlin, the old field vegetation and the clumps of pioneer tree species all present sufficient cover and forage for numerous bird and mammal species.

Mammals. Reconnaissance of the island revealed that a number of mammals frequent the area. Cottontail rabbits (Sylvilagus sp.) and striped skunk (Mephitis mephitis) have been observed on the island (Table 5.2.8-1). Raccoons (Procyon lotor) and numerous rodents have also been found on the island (Boston Harbor Comprehensive Plan, 1972).

Birds. A number of bird species have been observed on the island (Table 5.2.8-1). Pheasant (Pasianus colchicus), red-winged black bird (Agelaius phoeniceus), bluejay (Cyanocitta cristata), plovers (Charadriidae), herring gulls (Larus argentatus), great black-backed gulls (L. marinus), swallows (Hirundinidae), and crows (Corvus brachyrhynchos) were observed on the island. Of particular note was the sighting of three sparrow hawks (Falco sparverius) hunting over the island. The presence of these three raptors in the area suggests the presence of ample game in the form of insects and rodents (S&W Mgt. Cons., 1976). Reptiles and Amphibians - Few or no amphibian or reptile species are expected to inhabit the island because of lack of suitable habitat.

Endangered and Threatened Species

No endangered or threatened species are known to inhabit Deer Island. The US Department of Interior (USDI) list of species protected under the Endangered Species Act of 1973, as amended, contains only four species of terrestrial vertebrates whose geographic range includes Massachusetts (USDI, 1986).

Mammals. The Indiana bat (Myotis sodalis) has been recorded in a single locality in Massachusetts (Chancy, 1976). Although no individuals have been found in many years, it may still occur in the emery mines in Hampden County, Massachusetts. The mines have been given to the Massachusetts Division of Fisheries and Wildlife in an effort to protect remnants of the bat's population. It is unlikely that this species would be found on Deer Island.

Birds. The bald eagle (Haliaeetus leucocephalus) and peregrine falcon (Falco peregrins tundris and F. p. anatum) are all listed as endangered. The bald eagle is characteristically a bird of seacoasts, large remote lakes, and river shores. Today, no known breeding populations are found in the state. However, a hacking program by state and federal wildlife agencies (28 eaglets in five years at the Quabbin Reservoir) has reintroduced the bird to Massachusetts (Dyer, 1987). The program is scheduled to continue for another three years.

The 1987 winter bird survey found 42 eagles (possibly including a few golden eagles) in the Quabbin Reservoir area and 54 eagles state wide (Dyer, 1987). So far none has nested in the area but sexual maturation takes five years and nesting may occur in the next few years. Although it is highly unlikely that bald eagles will ever nest in the Harbor Islands, even with an increase in their numbers, because of the levels of human activity (Dyer 1987), there is now the possibility of eagles visiting the area while migrating to other parts of New England.

TABLE 5.2.8-1

LIST OF FLORA AND FAUNA OBSERVED AT DEER ISLAND

WOOD SCRUB

Type	Scientific Name	Common Name	Occurrence*
Trees	Pyrus sp.	Apple	Abundant
	Prunus serotina	Black cherry	Abundant
	Prunus sp.	Cherry	Common
	Catalpa sp.	Indian bean	Infrequent
	Rhus typhina	Staghorn sumac	Common
	Rhus glabra	Smooth sumac	Common
	Populus tremuloides	Quaking aspen	Infrequent
	Populus grandidentata	Bigtoothed aspen	Infrequent
	Populus deltoides	Cottonwood	Infrequent
	Acer sacchrum	Sugar maple	Infrequent
	Acer rubrum	Red maple	Infrequent
	Crataegus sp.	Hawthorn **	Infrequent
Shrubs and Vines	Rubus canadenisi	Blackberry	Common
	Vitis sp.	Grape	Infrequent
	Asparagus sp.	Asparagus	Infrequent
	Rose sp.	Rose	Infrequent
	Myrica pensylvanica	Bayberry **	Infrequent
	Spiraea sp.	Spirea	Common

OPEN FIELD

Forbs	Daucus carota	Wild carrot	Abundant
	Ambrosia artemisiifolia	Common Ragweed	Abundant
	Solanum dulcamar	Deadly nightshade	Common
	Datuar strumonium	Jimson weed	Infrequent
	Solidago spp.	Goldenrod	Common

Note: * Abundant - Frequently found, wide distribution
Common - Often found, scattered distribution
Infrequent - Seldom found, scattered distribution

** Old Field Vegetation

TABLE 5.2.8-1

LIST OF FLORA AND FAUNA OBSERVED AT DEER ISLAND (Continued)

	Cichorium intybus	Chicory	Common
	Tanacetum vulgare	Common tansy	Common
	Trifolium arvense	Rabbit's foot clover	Infrequent
	Potentilla canadensis	Dwarf cinquefoil	Infrequent
	Asclepias sp.	Common milkweed	Common
	Gramineae	Grasses	Common-Abundant
	Convolvulus arvensis	Field bindweed	Common
	Saponaria officinalis	Bouncing bet	Common
	Silene nivea	Snowy campion	Common
	Arctium minus	Common burdock	Infrequent
	Erigeron sp.	Daisy fleabane	Infrequent
	Petunia sp.	Petunia	Infrequent
	Solanum sp.	Tomato	Infrequent
	Linaria vulgaris	Butter and eggs	Common
	Phragmites sp.	Giant reed	Common
		FAUNA	
Mammals	*Sylvilagus* spp.	Cottontail rabbit	Common
	Mephitis mephitis	Striped skunk	Common
	Procyon lotor	Raccoon	Infrequent
	Rodentia	Mice and voles	Common-Abundant
Birds	*Agelaius phoeniceus*	Red-winged black bird	Abundant
	Cyanocitta cristata	Bluejay	Common
	Corvus brachyrhynchos	Crow	Common
	Larus argentatus	Herring gull	Abundant
	Larus marinus	Great black-backed gull	Common
	Hirundinidae	Swallow	Abundant
	Charadrius sp.	Plover	Common
	Pasianus colchicius	Ring-necked pheasant	Common
	Falco sparverius	Sparrow hawk	Common

Native breeding populations of the peregrine falcon have been completely extirpated throughout the eastern US, and the arctic peregrine now occurs in the region as a spring and fall migrant. However, the American peregrine falcon has also been successfully reintroduced along the east coast and in particular in Boston (Horwitz, 1986). It is the only species listed by the Federal government as endangered which is likely to be found near Deer Island. A pair of peregrines, a three year old Boston male and a three year old Canadian female, have taken up residence on the McCormick Courthouse Building in Post Office Square and have successfully nested (French, 1987a). This is the first successful nest in Massachusetts in 36 years (French, 1987b). These birds hunt primarily in the Boston Harbor Islands and thus have a high likelihood of visiting Deer Island.

Of the vertebrates listed in Massachusetts as "threatened" (Ritzer and Franzen, 1975), only one species, the Ipswich sparrow (Passercules princeps), could occur in the area of the Harbor Islands. The sparrow, classified as a subspecies of the Savannah Sparrow, breeds only on Sable Island off the southern coast of Nova Scotia. It winters along beaches, sand dunes and coastal marshes from Massachusetts to Georgia.

Sensitive Communities

The Massachusetts Natural Heritage Program (Michaud, 1987) has no record of any rare plant or animal species or unusual plant communities on Deer Island. National Wetlands Inventory maps show no freshwater wetlands on Deer Island, other than the wastewater treatment plant reservoir at the top of the drumlin (USDI, 1987). No wetlands qualifying under M.G.L. Chapter 131, S40 were found during the site visits.

Environmental Stress

Major environmental stress that can alter growth and development of biota includes plant diseases, insect pests, pesticides, fire, drought, winds, ice and snow, agriculture activities, air pollution, recreational activities, and, occasionally, vandalism. Deer Island has served as a site for a variety of municipal facilities dating back to colonial times. It was the site of an internment camp for hostile Indians, a reformatory, and a quarantine hospital, and it has served as the outlet for the metropolitan area's sewage since the late 1860s. It also was the site of a cemetery and burial areas.

A majority of Deer Island has been subjected to extensive modifications and disturbances, particularly within the last 100 years. The most extensive have included the construction of concrete bunkers, radar and radio facilities, and access roads. Related grading of slopes associated with Fort Dawes (1941) disturbed a substantial amount of the drumlin and land areas to the south. The subsequent construction and modifications of the Deer Island Treatment Plant (1968) added to this disturbance over the central part of the island. The prison and prior uses in the northern part of the site had previously disturbed the area to the north and northwest of the drumlin. The plant water reservoir at the top of the drumlin is operated by MWRA.

Because of the extensive land modification caused by more than 100 years of periodic construction activity on Deer Island, very little area on the island has been untouched. As a result, there are no pristine or mature habitats on the island or on its shores and vegetation present on the island consists mainly of weedy invasion species.

Nut Island

Site Conditions

Nut Island is a small peninsula approximately 1,500 feet long and 500 feet wide (Figure 5.2.5-2). It consists of a substantially altered drumlin connected by a man-made causeway to a second drumlin on the mainland. The island is devoid of significant natural futures; any that existed when the island was in its original condition were eliminated when the site was employed for the wastewater treatment plant. The open space on the south end of the island is maintained as cut grass.

Flora

Weedy forbs and managed grasses are the only plant life found on the island. No wildlife habitat is present other than perching places for occasional birds.

There are no wetlands on the island (USDI, 1987).

Fauna

Visiting gulls are the only evidence of wildlife found on Nut Island. Due to the high level of human activity on the island and the toal lack of nesting and foraging areas, no other fauna of any significance are expected to use the island.

Endangered and Threatened Species

Because of the industrial nature of the site and the high level of human activity, no endangered or threatened species of any kind are expected at the Nut Island site (USDI, 1986).

5.3 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Deer Island's historical and archeological resources date from the period from the 1840s to about 1930. They consist of a cemetery and mausoleum, the Deer Island House of Correction, and the Deer Island Pumping Station. Public Archeology Laboratory, Inc. (PAL) conducted the archeological surveys in 1985 to 1987, and Boston Affiliates, Inc. performed the survey of historical structures during the same period.

5.3.1 CEMETERY AND MAUSOLEUM

As part of the siting process for this project, a reconnaissance-level archaeological survey was conducted by Public Archaeology Laboratory, Inc. (PAL) in September, 1985 to identify and document cultural and archaeological resources as well as to assess the extent of previous disturbance within the designated project area.

In the course of the archaeological reconnaissance survey, an historic period cemetery and mausoleum were identified on Deer Island. (Figure 5.3.1-1). The cemetery plot and associated vault are located on a slope on the northeast side of the island between the old piggery and the concrete boundary wall that originally separated the City of Boston property from the U.S. military reservation on the southern half of Deer Island. It is referred to hereafter as the northeast, or new, cemetery.

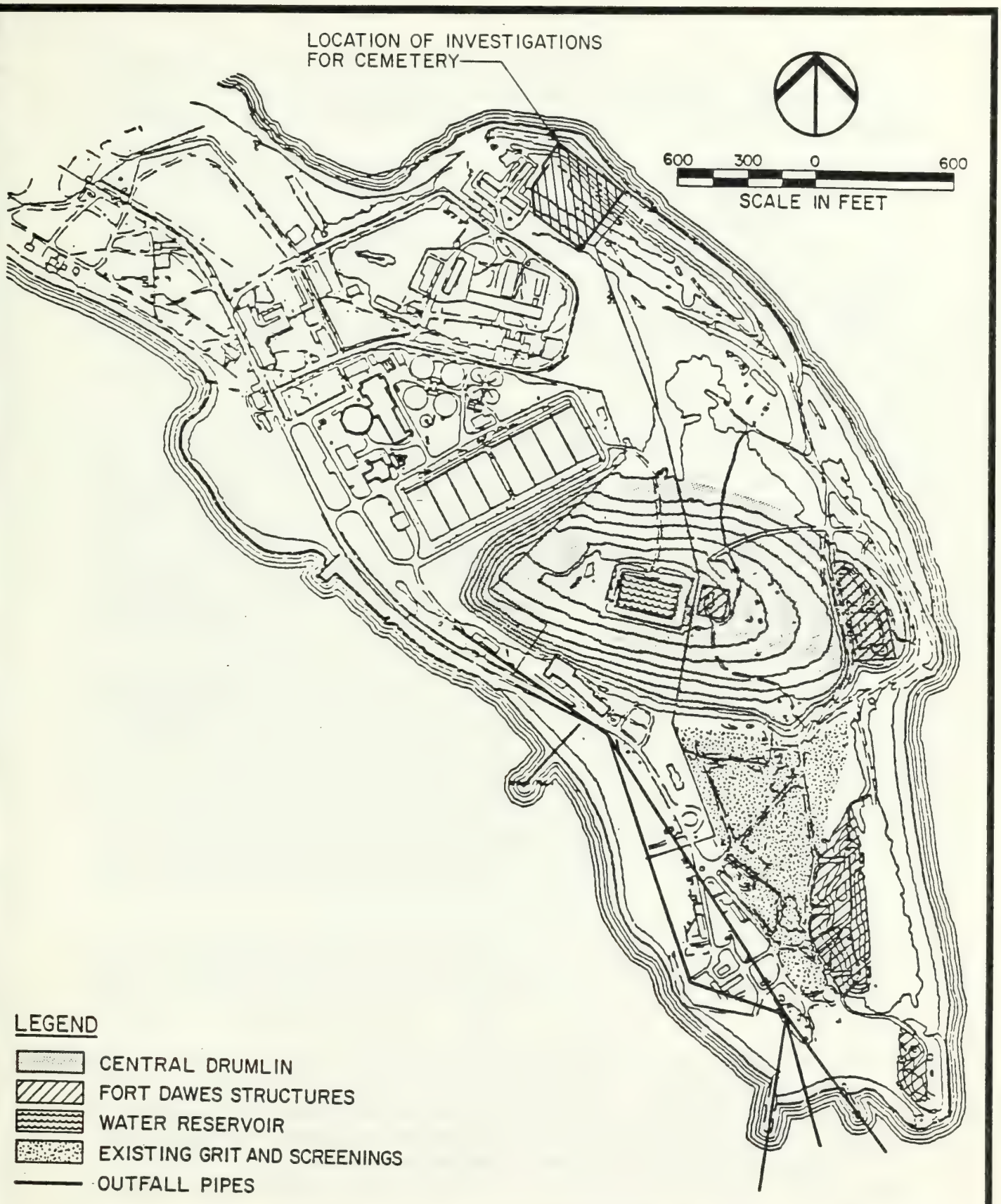
A more intensive archaeological survey was carried out in 1987 by PAL to assess the significance of the historic period cemetery. The survey was carried out in two basic stages: documentary research, followed by site verification.

The specific objectives established for the documentary research were: (1) to establish the period of active use of the cemetery identified during the reconnaissance survey; (2) to establish if this cemetery is older than the 1908 mausoleum associated with it; (3) to determine, if possible, whether the cemetery contains any burials that were removed from earlier nineteenth century plots formerly located on other sections of Deer Island; (4) to determine if the cemetery plot near the 1908 mausoleum could contain older (possibly nineteenth-century) reinterred burials; (5) to consult records maintained by the military (Army Corps of Engineers) for any information relevant to the final disposal of burials from Resthaven Cemetery on the southern tip of Deer Island; (6) to determine when Resthaven Cemetery was first actively used by the correctional facilities; and finally, (7) to locate documentary sources describing the methods used in the burial of almshouse or prison inmates on Deer Island (individual graves, large trenches, etc.).

The documentary research indicated is that the new northeast cemetery plot, or New Resthaven, was much larger than expected from the cursory field inspection of the site. Judging by a 1929 photo (included in Appendix P of Volume III), the cemetery extended from the northeast wall of the old piggery to the cement boundary wall and from the sea wall at the top of the slope to the mausoleum at the foot of the slope.

The objectives for the fieldwork were to determine the horizontal extent of the cemetery through systematic subsurface testing, and to collect sufficient data to reconstruct the internal configuration or plan of the cemetery and general mode of burial used at this site.

The site verification phase (fieldwork) of the study employed two procedures. First, geophysical data was collected through remote sensing using electrical resistivity and proton



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FIGURE 5.3.1-1
LOCATION OF CEMETARY INVESTIGATIONS

magnetometer surveys, to detect subserface disturbance in the soil and guide excavation for the location of unmarked burials. These results were used in conjunction with consultation with the Massachusetts Historical Commission (MHC), to plan an effective subsurface testing program.

Moisture content, granular size, density, and chemical content are factors which contribute to soil variations which are detectable by the resistivity survey. Using this method, the shaft feature from the excavation and refilling of a burial is detectable as higher resistance. Mineral content of soil, specifically the presence of mangetite or related minerals, will affect its magnetic susceptibility. Anomalies caused by the digging and refilling of holes will mix the mangetic domains of the soil and will register as areas of slightly lower magnetic intensity which can be measured by the proton magnetometer. Historic burials may also offer a different target anomaly if a coffin is used which contains metals having magnetic properties such as iron.

The results of the geophysical/remote sensing survey are described in Appendix P of Volume III. Based on these results and the documentary research, a total of ten trenches were subsequently excavated using a combination of machine-assisted and hand excavation techniques. They were aligned judgementally to cover as much of the project area as possible with some trenches aligned to test the specific anomalies located by the remote sensing survey, and others were laid out to test the cemetery boundaries indicated on the photograph of the cemetery area. The area of testing for establishing boundaries extended beyond the boundary determined by documentary research to include marginal areas that might have been used as a burial ground before and after the date of that photograph.

After consideration of all the evidence, it appears most likely that the cemetery in question is "New Resthaven Cemetery" created in 1908 with the reinterment of some 4,160 bodies from the old Resthaven Cemetery in the military reservation. The cemetery, at its present location, is 79 years old, or greater than 50 years in age. In addition, 2,559 of the bodies reinterred in New Resthaven are 100 years in age or older, many of them being quarantine hospital victims and Irish immigrants. An additional 92 unclaimed bodies were interred in the cemetery subsequent to its creation. The last recorded burials on the island occurred in 1946. As no evidence has been found suggesting the removal of these burials to another location, it is expected that some 4,252 bodies remain interred in the cemetery.

The documentary research initially suggested that the New Resthaven cemetery was potentially much larger than expected from the cursory field inspection of the site. Based on the 1920s photo, the cemetery appeared to extend from the northeast wall of the old piggery to the cement boundary wall mausoleum at the foot of the slope.

Photographs from 1939 and 1940 show less extensive cemetery boundaries. This smaller cemetery plot is restricted to the portion of the slope above the mausoleum from the cement boundary wall northward approximately 30 to 40 meters to a picket fence. Archaeological fieldwork tended to confirm this smaller cemetery boundary. Only one trench, located within the confines of the smaller cemetery boundary, produced features related to the presence of an historic cemetery: wood and human bone were found in a very poor state of preservation. No grave shaft

features were located in any of the other trenches. These data suggest that the cemetery did not extend more than a short distance beyond the northeast edge of the mausoleum. Figure 5.3.1-2 shows the probable revised boundaries of the cemetery based upon the documentary and subsurface testing data. The northwest boundary is an approximation primarily based upon the photographic evidence.

Evidence for the internal configuration and mode of the cemetery was provided by the historic photographs and the locations of features in the one trench where remains were observed. The presence of a gridded pattern of wooden crosses in the historic photographs suggests individual graves packed close together. It is also possible that the crosses marked bodies buried in trenches or in a mass burial.

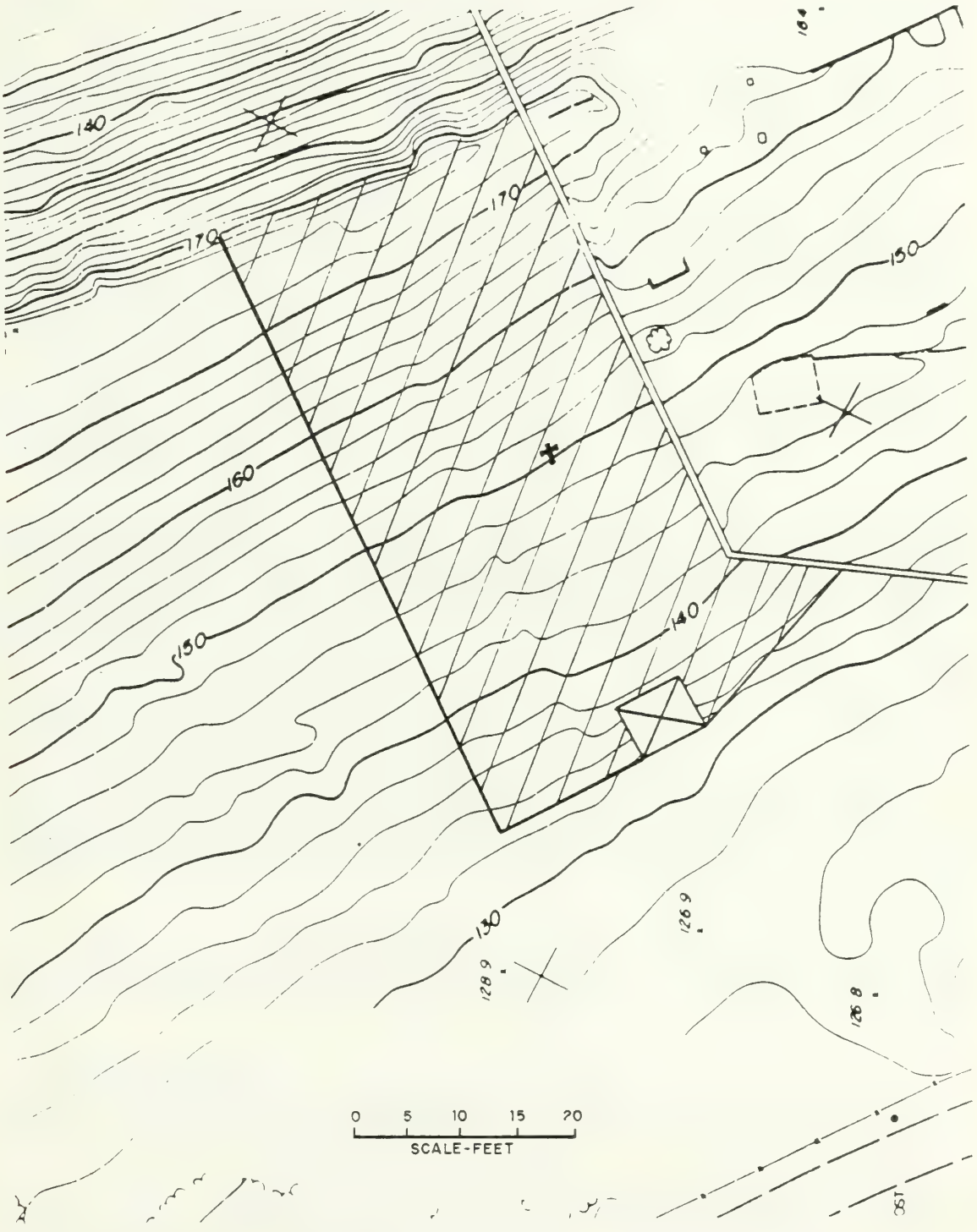
An attempt to count the number of crosses in the photographs led to another possibility. There were approximately 79 crosses in the area above the mausoleum between the concrete wall and picket fence visible in the 1929 photograph in Appendix P of Volume III. This correlates closely with the total of 92 bodies buried on Deer Island after 1908. It is possible, therefore, that the burials and crosses correspond to these 92 "new" interments (between 1908 and 1946). This leaves the loation of the reinterments unclear. Considering the very poor preservation of the wood and bone which was found and the large otherwise unexplained geophysical nomaly in part of the area which was tested, it is possible that the reinterred bodies were buried in a mass grave in this location in 1908. Subsequent burial of the more recent bodies and the intervening 79 years may have erased most evidence of these 4,160 reinterred bodies.

A number of factors may have combined to cause the poor preservation exhibited by the burial that was found and the general lack of visible burials. First is the age of the burials, especially the reinterments. The majority of the burials predate 1850. Second, there is no evidence to suggest that any of the bodies were embalmed before burial. Indeed the 1934 memo indicates that this was not done in the more recent period. Third, it is highly unlikely that the earliest, and therefore the majority, of the burials were interred in coffins. This could tend to detract from preservation potential. Fourth, no information was located concerning the methods used to exhume and then reinter burials in 1908: it is unlikely that great care was taken in their transfer. Finally, the cemetery's location on the bluff near the Atlantic ensures the frequent drenching of the plot by salt water and spray during storms and high seas. The corrosive nature of salt water may have contributed to the poor preservation of the burials.

5.3.2 DEER ISLAND HOUSE OF CORRECTION

History

Owned by the City of Boston since 1634, Deer Island in Boston Harbor has proven a useful place for purposes that needed a site, but that had to be set apart from a populated area. Its use has included the detention of Indians and the quarantine of contagious immigrants.



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 5.3.1-2
REVISED BOUNDARIES OF NEW REST HAVEN CEMETERY, DEER ISLAND

In 1850 the City sited a municipal almshouse there, which became the first in a complex of institutions serving the poor, the criminal and the delinquent. The almshouse was known as the House of Industry; other buildings, such as a reformatory, and schools for pauper boys and girls, were added in the next three decades. In the 1890s the whole complex started being used for the detention of prisoners, and was called the House of Correction, the name still used today.

The Deer Island group of institutions for many years was self-sufficient, providing its own food from animals and farming. Dairy barns were built as late as the 1950s but farming has now ceased. The Island was accessible by boat, and the Penal Institutions Department maintained its own steamboat to transport inmates between islands and the mainland. In 1940 the Island was connected by causeway to Point Shirley in Winthrop.

Deer Island has not previously been surveyed for historical significance. Consequently, none of the buildings are listed in official inventories or have been identified as eligible. The main points of historic interest are the following:

1. Administration Building (ca. 1850, 1929, 1949)
This building incorporates major sections of the Deer Island Almshouse (also known as the House of Industry), designed by Gridley J. F. Bryant (1816-1899) with the assistance of Louis Dwight of the Prison Discipline Society. The original building was of brick, in Italianate and vernacular style.

Fire damage in 1929 and 1949 led to the removal of the roof and portions of the building. Modern sections were added at the back.

Interior hallways and offices on the first floor have woodwork, matchboard panelling, and cast-iron columns which are apparently original. The cell-block appears to date from the late nineteenth century, and is probably the addition designed by City Architect, Edmund Wheelwright in 1892.

The building is now used as administrative offices, reception and cells for new prisoners, training and schoolrooms, and workshops. The building appears structurally sound but worn and neglected.

2. Hill Prison (1902-04)
This building appears to be substantially unaltered. It was built as a women's prison, but is now the main prison in the complex, occupied solely by men.

The architect was A. Warren Gould, active in the 1890s in Boston, where he designed a number of houses and buildings in Dorchester, including Whiton Hall for the Dorchester Women's Club. He moved to the Pacific Northwest and died in Seattle in 1922.

The building is T-shaped. The two wings contain cell-blocks, the rear wing dining and recreational facilities. The building is of loadbearing brick, 24 in. thick at first floor level; the foundations and entrance facade are granite. The floor construction is reinforced concrete, and brick vaults span the cell-block open areas. Interior supports are cast-iron columns and masonry. The pitched roofs are covered with slate.

The style of the building is classical revival. The central section has a granite facade in the lower half, brick in the upper half. In the granite section, two projecting bays flank an arched entrance in Palladian style, above which is a recessed balcony set in a semicircular arch. Above are a series of vertical brick pilasters between windows, topped by an entablature and surmounted by a hipped roof with clipped dormers and a prominent cupola.

The two wings contain a series of wide brick pilasters alternating with narrower barred windows arched at their tops. Since these windows give onto the open space of the cell-blocks, there are no floors behind them, and the windows are virtually continous strips. Above is a broad entablature. The roof is pitched, and has ventilators at the ridge, which were once open roof viewing platforms. The end walls of the wings have the same pilaster and arched window motif of the front and rear elevations; the windows are bricked up.

The rear wing, also roofed with a pitched slate roof, has a series of brick semicircular arches, with windows at each floor level. In the uppermost floor -- the recreation hall -- the upper section of the window is blocked with plywood. The end wall of this wing is the stage wall, and is solid brickwork. The outer skin of this wall collapsed recently, and has been replaced.

Inside the building, most of the spaces are utilitarian. There is some architectural interest in the front entrance hall and in the recreation hall, which still retains original woodwork in the doorways, stage and proscenium arch, and balcony.

The building appears to be structurally sound. Inside, all surfaces show signs of much wear, poor maintenance, makeshift repairs and careless painting.

3. Superintendent's Office (1930)
This red brick building, situated on the waterfront opposite the Administration Building, originially housed doctors and other professional staff of the Deer Island HOC.

The building, which resembles a traditional single-family home, is Georgian Revival in style. It is composed of a rectangular 2-1/2 storey block with a high-pitched slate roof and a flat-roofed single storey service wing to the side. It is faced with Flemish Bond red brick and has a cast stone foundation and details.

The main facade has three bays of windows on either side of a central entranceway consisting of a pair of Corinthian columns and a segmental arch. The front slope of the roof has five gabled

dormers; the rear of the structure has four dormers and four pairs of french doors leading onto a cast-stone terrace.

The Superintendent's Office was initially believed to date from circa 1910, based on visual analysis. Subsequent research, however, has indicated that it was constructed in 1930 to replace the original doctor's wing destroyed in the fire in the Administration Building in 1929. The structure was designed by the M.A. Dyer Company, a Boston architecture and engineering firm.

Subsequent to its use as the doctors' house, the structure became the Penal Commissioner's residence. Beginning in 1973, it housed inmates participating in the Work-Release program. In 1985, the building was renovated for use as office space. This renovation resulted in considerable alteration to the interior and the replacement of the original windows with vinyl copies.

4. Ancillary Buildings
   a. Garage - 20th century.
   b. Commissary - 20th century. This building, previously three and a half stories, was reduced to a one-storey building in 1946.
   c. Dormitories (former Dairy Barns) - 1957 and 1958. Architect, Joseph F. Page.
   d. Shower Block - probably the former Poultry House, 1957. Architect, Joseph F. Page.
   e. Chapel - 1950's.
   f. Power Plant - 1958. Engineers, J. M. McKusker Associates.
   g. Dormitory and Laundry (opposite Hill Prison) - this building may be a remnant of the nineteenth century pauper girl's school.
   h. K-9 Quarters - 1980's. On site of former piggery.
   i. Work Release House - 1920's (?)
   j. Sheet Metal Shop - 20th century.

5. Site Plan (ca. 1850 to present)

   The Deer Island House of Correction consists of a grouping of major and ancillary buildings informally sited in an institutional yet rural setting.

   The buildings form two clusters. Near the water's edge, the predominant building is the Administration Building, sited parallel to the main road that traverses the island. Opposite the Administration Building is the Superintendant's Office; nearby is the Work Release House. Behind the Administration Building and parallel to it are a Garage and Commissary.

   Up on the hill the predominant structure is the Hill Prison, sited on a street sometimes referred to as Hill Prison Street. Across from the Hill Prison is the Dormitory and Laundry. Next to the Hill Prison are two Dormitories, a Chapel, and Shower Room, and the Power House. Below and across a road is the Sheet Metal Shop. Behind the Hill Prison are the K-9 Quarters.

The buildings are informally set on the site which has a character that is institutional, industrial and rural. There is a loop road that gives vehicular access to all buildings. It is paved, but without curbs in most places. The largest expanse of paved area is between the Administration Building and the Garage and Commissary. Stone retaining walls and foundation walls of demolished buildings occur on the site. Cyclone fencing and wooden telephone poles are in evidence. Trees, bushes and an overgrowth of grass contribute to the rural character of the site.

Significance

The Massachusetts Historical Commission reviewed the historical and architectural survey in December, 1987 and made the following finding about the Deer Island House of Correction's historical significance (see Appendix P):

> We . . . found that the Deer Island prison complex does not meet National Register of Historic Places Criteria, but that several components individually meet NR criteria.
>
> While individual components of the Prison Complex do retain integrity to their period of significance, the complex as a whole does not, having been altered through the construction of numerous small utility buildings in the 1940s, 1950s, and 1960s and through the demolition or substantial alteration of original elements and significant later structures, such as the ca. 1850 House of Industry and the Pauper Boys' School.
>
> Components considered to retain integrity to their period of significance and to meet National Register criteria A and C on the local level are the following:
>
> Hill Prison (1902-04) - Classical Revival building retaining significant elements of its design; significant for its associations with the development of institutional controls in the city of Boston; as an illustration of the continued usage of the Harbor Islands as the historic location of undesirable social institutions (Boston's institutional fringe) and architecturally as a good example of turn-of-the-century institutional design and practice, reflecting current philosophies regarding criminal justice and social reform.
>
> The Superintendent's Office (ca. 1910) is an excellent example of Georgian Revival architecture in a good state of preservation. Historically, the office reflects the importance and high status of the Superintendent in its prominent siting and imposing design. (Further research has shown that this building was built as the Doctor's House in 1930.)

5.3.3 DEER ISLAND PUMPING STATION

History

In 1889, legislation, prompted by reports of the Massachusetts State Board of Health on

pollution of Boston Harbor, authorized the formation of the Boston Metropolitan Sewerage Commission. By 1900, the North Metropolitan Sewerage System, serving the 14 cities and towns of the Commission's northern region, was fully operational.

The North Metropolitan system's 74 miles of sewer lines connected nearly 1,000 miles of local lines and pumped to an outlet in the Boston Harbor at Deer Island. The Pumping Station at Deer Island was the largest of three stations constructed to pump sewage through the North Metropolitan system. Constructed in phases in the period from 1894 to 1900, the development of Deer Island Pumping Station reflected the growing needs of the region's burgeoning population.

The Pumping Station at Deer Island lies on the southwesterly side of the island about midway down its length. Actually a complex of five attached buildings, the development of the station reflects the development of the North Metropolitan Sewerage System which it served. Completed in three phases between 1894 and 1899, the complex contains a Screen House, Coal House, Boiler Room and two Engine Rooms. A coal wharf, a trestle with an intake and discharge pipe, a residence, and a masonry outlet conduit are also part of the original sewage works. The buildings give the appearance of a single structure, designed in a compatible manner by Arthur F. Grey, architect for the stations at Charlestown and East Boston. Though operated in the periods between construction, it became fully operational in May of 1900. The Station was in operation until 1968 when the Deer Island Sewage Treatment Plant was completed. The building, still containing the old machinery, is now abandoned. To the southeast of the pumping station complex is a two-storey shingle structure referred to as the Farmhouse.

Following is a brief description of each of the significant components remaining on Deer Island.

Screen House (ca. 1895)

The Screen House is two-storey brick, granite, and terra cotta structure 27 ft x 23 ft. Built in a simple vernacular industrial style with Queen Anne-Romanesque elaborations and detailing, it has a hipped roof of slate with terra cotta tile coping and is surmounted by a cupola, now only partially extant. The Screen House and the adjacent Coal Pocket were constructed after the Boiler Room and the first Engine Room.

The building covers the screen shaft of the pumping station system and contains machinery for hoisting and pressing. Sewage was screened wtih double rows of wrought iron bar cage screens before it was put through the pumping machinery.

The screening apparatus comprised two separate but similar pieces of equipment that contained a series of vertical screens of steel bars suspended above the incoming sewer conduit by a chain-driven hoisting system powered by small steam engines. The two-story structure on the northwest corner of the present pumping station was the original screen house completed in 1895. With the expansion of the station in 1909, an additional screening apparatus was added behind the original building as part of the coal house addition.

Coal House (ca. 1895)

The Coal House is a one-storey brick, granite and terra cotta building, 74 ft x 34 ft with a dynamo room attached. Styled similarly to the Screen House, it also has a slate pitched roof punctuated by dormer-type openings and terra cotta tile coping.

The engines for the pumping station were powered by coal burned in the boiler room until the facility was converted to diesel fuel in the 1950s. The Coal House was designed to hold 600 tons of coal.

The original Coal House was designed with large dimension interior wooden timber framing that supported and reinforced concrete walls. As part of expanding the facility's capacity in 1909, a rear addition was made. The addition also provided for the construction of a second screen room adjacent to the original screen house.

Boiler House and Chimney (Sept., 1895)

The Boiler House is one-storey brick, granite, and terra cotta structure, 63 ft x 35 ft, with a height of 17 ft to the roof trusses and an accompanying masonry chimney 125 ft in height. The structure is styled in a vernacular Romanesque with Queen Anne details, slated pitched roof with terra cotta tile coping, and is topped with a ventilation structure.

The boiler house has three pairs of boilers, two pairs of which were installed when the facility was initially constructed in 1895. All are of the horizontal return-tubular type, and are attached to a Green fuel economizer. The original boilers installed in 1895 were supplemented by a larger pair of boilers that were added in the expansion of 1909.

Converted from coal to diesel in the 1950s, the boilers still remain intact. The boiler room and the first engine room were the initial structures built for the pumping station, which shares its pattern of boiler room-engine room with the stations at East Boston and Charlestown.

Engine Rooms (1894 - 1899)

The original engine room was a one-storey brick, granite, and terra cotta structure, 100 ft x 31-1/2 ft, with a height of 15 ft to the roof trusses. Styled in a vernacular Romanesque with Queen Anne detailing, it also has a pitched slate roof punctuated by dormer-type openings with terra cotta tile coping. Similar to the stations at East Boston and Charlestown, it was originally equipped with two triple-expansion Corliss-type steam engines.

The original configuration in the engine room of the pumping station allowed for three centrifugal pumps with impellers 8.25 feet in diameter, each driven by a horizontal, triple-expansion steam engine of the Reynolds-Corliss type.

The two initial engines and pumps installed in the plant were operational by 1896, and in

regular service by 1897. In May, 1900, a third engine and pump identical to the two original engines and pumps was placed in service. During that same year, an additional pump pit was excavated at the south end of the original engine room in order to allow for the addition of a forth engine and pump. During the period of 1909-1910, a two-storey brick structure, approximately 50 ft by 50 ft with a hipped slate roof, was completed at the southeast end of the engine room. The structure is built in a more formal style with Romanesque details of round-headed arches, brick patterns to create circles, and horizontal lines denoting function. A 100 mgd pumped was installed by the Allis-Chalmers Company with an engine of the same triple expansion type but of larger dimensions than those previously installed.

The installation of diesel engines in the 1950's resulted in the removal of the three original steam engines. However, its likely that the original centrifugal pumps remain in the pump pits. Only the block of a single diesel engine remains at the middle of the three original pumps. The forth steam engine and pump, the original Reynolds-Corliss equipment installed in 1909 by the Allis-Chalmers Company, remains over a centrifugal pump in the southeast addition to the engine room.

Farmhouse (ca. 1900)

Approximately 300 feet to the southeast of the Pumping Station stands a two-storey wood and shingle Queen Anne/Colonial Revival structure that is known as the Farmhouse. Physical evidence indicates that the original structure, a simple rectangular two-storey barn, received later additions, probably around the turn of the century. The original barn forms the north wing, while the later construction consists of the central stable-like area and the attached south wing. The south wing apparently was designed and used as a residence for employees of the Pumping Station, and possibly the Superintendent. Employees of the Pumping Station at various times used the north and central wings as a locker building, tool room, stable, and garage. The M.D.C. at one time used the Farmhouse as a storage area for old documents, tires, and sand. It is now in dilapidated condition.

Related Features

There are three structures apart from the pumping station building that are important components of the Deer Island Sewerage Works: the outfall conduit, the coal wharf, and the seawater intake and discharge pipe.

The original coal wharf with trestle constructred for the pumping station extended 407 feet southwesterly from a point in front of the screen house. At the screen house the trestle curved toward the building, making a 90 degree turn into the side of the coal house. When the addition was made to the coal house in 1909, an extension was constructed extending the trestle to the side of the new coal house.

The outlet conduit south of the pumping station was constructed by the coffer dam method until it reached deep water. From there, the conduit was extended by specially constructed sections of wooden pipe of reinforced oak hoops lined with portland cement. The pipe sections were 52

feet long, 6 feet 3 inches in diameter, and weighed up to 210,000 pounds. The total length of the outlet conduit was 1,925 feet, extending from a point approximately 60 feet inside high water line to a point opposite the Deer Island Light.

A pair of sea water intake and discharge pipes of cast iron enclosed and supported by a wood trestle were constructed perpendicular to the boiler house. The trestle extended several hundred feet from the shore, and included a sea water well at approximately the mid-point of its overall length.

Significance

Available documentation and preliminary inspection of the Deer Island Sewerage Works indicates that the following engineering components and related features remain at the property:

1. Three centrifugal pumps, each with a daily capacity of 45 million gallons per day;

2. A 100 million gallon centrifugal pump connected to a horizontal, triple-expansion steam engine;

3. Two sewage screening machines, with many gears and the small steam engines used to operate the lifting apparatus removed;

4. Boilers, economizer and 125 foot stack;

5. Sea water intake and discharge trestle with pipe;

6. Wooden discharge conduit extending to Deer Island Light.

In spite of the water penetration, the steel and heavy timber framework of the pumping station continues to support the roof and walls of the individual sections within the overall structure.

The Deer Island Sewage Works (1894-1909) retains many historic engineering and architectural features which support its eligibility for the National Register of Historic Places. The property is important as an early manifestation of regional planning for public health and safety. The property is a central component of a larger system which was conceived and designed by individuals of national and regional importance. The property retains components of exceptional value to the history of mechanical engineering, and particularly, the application of steam technology to hydraulic engineering. The existing 100 mgd centrifugal pump is possibly the largest of its type ever manufactured, and is the only remaining example of a pump of its size in the U.S.

The Massachusetts Historical Commission, in its review of the historical and architectural survey of Deer Island, concluded the following about the Pumping Station (see Appendix E):

. . . we find that the Deer Island Pump Station Complex appears to meet National Register Criteria A and C.

The Pumping Station meets criteria A and C,

1) as a substantially intact sewage pumping complex illustrating the development of the Metropolitan District Commission, one of the earliest major environmental management agencies in the country, and of the City of Boston and its surrounding area, which experienced substantial growth at the turn of the century and

2) as an architecturally distinguished pair of buildings in the Romanesque Revival and Queen Anne styles. The pumping station, built between 1849-99, is notable for its high quality design and materials while the adjoining farmhouse is a particularly good example of Queen Anne/Shingle Style architecture.

6.0 WASTEWATER FLOWS AND LOADS

6.1 AIR AND WASTEWATER SAMPLING PROGRAM

During the fall of 1986 and the spring of 1987 Camp Dresser & McKee (CDM) conducted a wastewater, sludge, and air emissions sampling program.

The wastewater sampling was conducted during both the fall and the spring periods. The air sampling was only conducted during the fall period. The sludge sampling was only conducted during the spring period.

6.1.1 OBJECTIVES AND GOALS

The objective of the wastewater, sludge and air emissions sampling program was to collect statistically valid data that would quantify the unique character of the MWRA's existing influent wastewater, primary sludge, and air emissions.

The wastewater, sludge and air emission samples collected from the various facilities is an integral part of both the Secondary Treatment Facility Plan (STFP) and the Residuals Management Facility Plan (RMFP). The wastewater, sludge, and air emission samples are important because the data obtained are the basis for several other elements of the studies that define the proposed treatment facilities.

The three primary goals of the sampling program were to:

1. Provide data for the STFP to evaluate wastewater treatment plant processes, and outfall selection.

2. Provide data for the RMFP to evaluate probable sludge characteristics for residual treatment and disposal alternatives.

3. Provide data for the evaluation of air quality impact that would result from volatile organic compound (VOC) emissions and the odor potential associated with alternative wastewater treatment facilities.

To achieve these goals CDM and its sub-contractors followed a detailed quality control and assurance document (QA/QC), which is in Appendix B of this volume. The QA/QC conformed to EPA standards as defined in its 1984 publication entitled "Guidance for the Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring."

The individual samples' analytical results are detailed in Appendix B in four volumes entitled "Summary Memorandum FB20C Air and Wastewater Sampling Program." Volumes I through III are the results of the fall program. Volume I contains conventional, process, metals, acid base neutrals (ABN), polychlorinated biphenyls (PCB), and pesticides data. Volume II contains the results of wastewater VOC sampling. Volume III contains the results of air, VOC, and total nonmethane hydrocarbon (TNMOC) sampling. All the spring results are contained in Volume IV.

6.1.2 THE SCOPE OF THE SAMPLING PROGRAM

Sampling Locations

The two MWRA sewer service areas are called the South Metropolitan System and the North Metropolitan System, reflecting their relative locations. The South System reaches its terminus at Nut Island. The North System after preliminary treatment at four headworks (Chelsea Creek, Columbus Park, Ward Street and Winthrop Terminal) reached its terminus at Deer Island. In order to gather data it was necessary to collect samples from six influent wastewater locations, five effluent wastewater locations, two sludge pumping locations and three air emission vent locations.

Within the South System influent and effluent sampling locations were set up at Nut Island. The North System required more locations due to its more intricate design. In the North System influent and effluent sampling locations were set up at Deer Island, Chelsea Creek, Columbus Park, and Ward Street. An influent sample location was also set up at Winthrop Terminal. At all sites, the influent sampling location was placed at a point before screening facilities. At Chelsea Creek, Columbus Park, and Ward Street the effluent sampling locations were placed after the headworks grit and screening facilities. During the fall period, at Nut Island and Deer Island, the effluent sampling locations were located after primary treatment, and before the chlorination processes. During the spring period, there were two effluent sampling locations at Nut Island and Deer Island, one before the chlorination process and the other after the chlorination process.

During the spring, sludge sampling locations were set up at the sludge pumps at Nut Island and at the gravity thickener discharge at Deer Island. Alternate samples were taken from the two pumps at Nut Island. The samples from the four sampling points at Deer Island were also taken on a rotating basis.

For air emissions, sampling locations were set up at Chelsea Creek, Columbus Park, and Ward Street. At each site the sampling location was set at the top of the tunnel shaft, where the wastewater dropped several feet in the tunnel (either the North Metropolitan Relief Tunnel or Boston Main Drainage Tunnel that leads to Deer Island).

Constituents Sampled

The list of constituents to be analyzed was based upon process consideration as well as EPA and state guidelines. In total, more than 150 constituents were specified prior to sampling. These include all constituents from the:

Conventional Parameter List
Priority Pollutant List
Hazardous Substance List (Volatile Organics Only)
Massachusetts Sludge Metals List
Massachusetts Ozone Precursor Guidelines

In addition to the organic compounds that were specifically searched for, the presence of other organic compounds were identified by the use of comparation (library) searches of the mass spectrographs.

The specified constituents to be analyzed were categorized by analytical fractions. Samples were taken for each fraction based on a schedule and technique designed to ensure data quality for each fraction.

The fractions created for this sampling program follow, with the type of sample that was taken in parenthesis:

1) Conventional and Process Parameters (Wastewater)
2) Metals (Wastewater and Sludge)
3) Acid and Base Neutral (Wastewater)
4) Pesticides and PCBs (Wastewater and Sludge)
5) Volatile Organic Compounds (Wastewater)
6) Total Non-Methane Organic Compounds (Air)
7) Volatile Organic Compounds (Air).

6.1.3. DATA QUALITY ASSURANCE

The usefulness of the of the sampling program results depended upon the adherence to the data quality requirements that were incorporated in the QA/QC. Data quality is based on precision, accuracy, representativeness, completeness and comparability. There are several ways that the program design and the laboratory procedures guaranteed data quality. These are discussed below.

Duplicate Samples

Samples taken at the same location in the same manner and at the same time are considered duplicates. Duplicate samples should have nearly identical composition and minimal variation. By analyzing duplicate samples, the laboratories demonstrate precision and comparability in their analytical method.

At each sampling location approximately 5 percent of the samples were duplicates. The results from the analysis of duplicate samples has indicated that laboratory precision and comparability was within acceptable limits, unless otherwise noted in the reported data.

Blank Samples and Matrix / Surrogate Spikes

Distilled water is considered a blank sample. Blank samples permit the testing of the equipment to ensure its intrinsic neutrality during the testing process. Placing known quantities of certain constituents in distilled water will create matrix and surrogate spikes. By analyzing the spiked sample it is possible to determine if the testing equipment is capable of detecting the constituents that are being searched for. By analyzing blank and spiked samples, the laboratories demonstrate accuracy in their analytical methods.

Blank and spiked samples were analyzed throughout the testing of air and wastewater samples. Some minimal problems with the accuracy of the equipment was occasionally detected and are so noted in the reported data. Problems resulting from the large number of constituents that were being searched for during the tests occurred (most notably with boron during the fall sampling). The problems did not compromise overall data quality and were corrected when possible.

Multiple Samples

The collection of multiple samples on a given day, and the collection of samples over multiple days during different seasons, constitute multiple samples. By handling the multiple samples in a consistent manner, the laboratories ensure the representativeness of the samples taken. The sampling program was designed to collect multiple samples on multiple days during different seasons. These multiple samples were handled in a consistent manner ensuring data quality.

Statistically Significant Number of Samples

The program was structured to collect enough samples so that the confidence interval about the mean of the analytical results was small enough for the data to be considered statistically significant. In general, for compounds with little variability in analytical results, 20 samples is enough to be statistically significant. For other compounds such as VOCs, a larger sample field is necessary.

The sampling program specified the collection of hundreds of samples, assuming that a small percentage of samples collected and/or analyzed would be lost or considered invalid. A high percentage of the samples collected and analyzed were considered valid, therefore, enough samples were collected to meet the statistically significant data standards.

Comparability of Sampling Method and Analytical Procedures

Adhering to EPA Guidelines and industry standards constitutes approved sampling and analytical procedures. By using an approved sampling method and analytical procedures it is possible to ensure comparability of the results of individual samples with others in this sampling program, and with other sampling programs.

The sampling program adhered to the "Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March, 1983," thus ensuring that the program met EPA standards. The sampling program also adhered to the "Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985" ensuring that the program met industry standards. By meeting EPA and industry standards the sampling program satisfied the comparability criteria of data quality.

6.1.4 THE EXECUTION OF THE SAMPLING PROGRAM

The sampling program was conducted under the direction of CDM with the assistance of Alliance

Technologies Corporation for sample collection. Analysis was conducted by CDM's labs, Alliance Technologies' Labs, Research Triangle Laboratories Labs, and Mead Compuchem Laboratories.

Coordination for Concurrent Collocated Sampling

The average wastewater travel times from Chelsea Creek, Columbus Park, Ward Street, and Winthrop Terminal to the Deer Island Plant were taken into account in the establishment of sampling times. As a result, the sampling was staggered so that that any given sample of wastewater would have arrived at Deer Island at approximately the same time. By staggering the sampling times, it was possible to collect concurrent collocated samples.

The anticipated wastewater travel time from the Nut Island plant across the harbor to the Deer Island Plant was not taken into account.

Wastewater Sampling Technique

During the program influent samples were flow composited by collection by automatic sampling equipment. In the case of the plant effluent and VOCs, grab samples were taken. All wastewater samples are identified by sampling location, sampling date, and time.

Sludge Sampling Technique

Grab samples of raw primary sludge from the Deer and Nut Island plants were taken for 5 days. At Deer Island the sludge samples were collected every 4 hours from sampling taps located in the pump rooms in the basement of the Sludge Thickener Building. At Nut Island the sludge samples were collected every 4 hours from the various primary sludge pumps.

Air Sampling Technique

Air sampling for individual volatile organic species, as well as for total volatile organic concentrations, was done at Chelsea Creek, Columbus Park, and Ward Street during the fall period of the sampling program. At each site there is a vertical shaft where wastewater drops to a tunnel that leads to Deer Island. All air samples were taken from the tops of these shafts, which act as vents.

The shafts were selected for air sampling because as wastewater drops into the tunnels, VOCs are stripped from the wastewater by the turbulence. The rate of organic volatilization at treatment facilities is a new area of concern, and the sampling program attempted to differentiate between the concentration of VOCs in the wastewater and the rate of volatilization into the atmosphere.

Variables During the Sampling

Pollutants are likely to vary under different conditions. The following variations in the conditions that affect the treatment process were considered.

The sampling program was split between a fall period and a spring period. This split allowed groundwater conditions to be taken into account. Groundwater levels vary with the seasons. In the fall, groundwater is low, and in the spring, groundwater is high. The average wastewater flow during the fall was 227 mgd at Deer Island and 93 mgd at Nut Island. The average wastewater flow during the spring was 312 mgd at Deer Island and 174 mgd at Nut Island.

By taking samples under high and low groundwater conditions, it was possible to evaluate the impact of groundwater flow on constituent concentrations.

Most of the samples taken during the sampling program were flow-composited daily samples. As a result, these samples reflected the diurnal wastewater conditions.

In the case of VOCs that required grab samples, diurnal variation was taken into account by taking 4 grab samples per day at six-hour intervals. Chemical oxygen demand (COD) and total suspended solid (TSS) analyses were run on hourly samples collected from the two plants on two separate occasions.

Limitations of Laboratory Analytical Equipment

Even under the best conditions analytical laboratory equipment has limited precision and accuracy. Limitations include the smallest concentration of each constituent that can be identified and the accuracy of the reported value of the concentration.

The smallest concentration of a constituent that can be reported is called its detection limit. In general, the detection limits used for laboratory analysis during this sampling program complied with industry standards. For both metals and VOCs, the detection limits were made as low as feasible. The detection limit was lowered to provide usable data that would correspond to regulatory criteria for the allowable discharge level of the compounds.

While the detection limits were generally found to be acceptable in the Fall period of the sampling program, there was a problem with the detection limits of metals. Most of the samples tested in the Fall indicated that metals were below detection limits (BDL). As a result there was some uncertainty about the presence of the metals which were BDL. As a result the detection limits were further reduced during the Spring period of the sampling program. By reducing the detection limits to the lowest possible limits the metals data quality was raised to the highest possible level.

The calibration of laboratory equipment at low detection levels is delicate and is subject to error. While the QA/QC for laboratory procedures kept this error to a minimum the reported values are not exact. According to the laboratorys' documentation and quality assuance reports, the concentrations reported could be 15 percent more or less than the actual concentration. This range is commonplace within the industry and is of acceptable quality.

Laboratories Used to Test Samples

The wastewater samples taken during the fall sampling period were analyzed either by CDM's laboratory (process, conventional, and VOCs) or by Mead/Compuchem Laboratories Incorporated (PCBs, ABNs, VOCs). All of the wastewater samples for metals were analyzed by CDM's laboratory.

The air emission samples taken during the fall period of the sampling program were analyzed by either Alliance Technologies Corporation (total VOCs) or Research Triangle Laboratories, Inc. Compound Specific VOCs).

All PCB, ABN, VOC, and pesticide wastewater samples taken during the spring period of the sampling program were analyzed by Mead/Compuchem Laboratories Incorporated. Mead/Compuchem was used to analyze all spring samples because its laboratory was able to detect constituents at lower concentrations than the CDM laboratory. CDM's laboratory analyzed all of the metals, conventional, and process samples during the spring period.

CDM's laboratory performed metal analysis on all sludge samples taken during the spring period. Mead/Compuchem analyzed sludge samples for PCBs and pesticides.

No air samples were taken during the spring period of the sampling program.

6.1.5 SUMMARY OF SAMPLE COLLECTIONS

The sampling program was divided into two periods to allow the seasonal effects of groundwater levels to be evaluated. The first period, known as the fall period, took place from August 29, 1986 to September 26, 1986. The second period, known as the spring period, took place from February 29, 1987 to April 9, 1987.

Table 6.1.5-1 summarizes the number of samples collected by constituent category and by type of sample.

The Quality Assurance/Quality Control document (QA/QC) is included in Appendix B of this report. The complete sampling results are contained within a four volume set. Copies of the results are on file at MWRA and are available for inspection.

TABLE 6.1.5-1

TYPE AND NUMBER OF SAMPLES COLLECTED DURING FALL AND SPRING SAMPLING PERIODS

Constituent Category	Influent	Wastewater Effluent	Sludge	Air	Total Samples
Fall Sampling Period					
1) Conventional and Process	162	4	---	---	170
2) Metals	40	4	---	---	44
3) Acid and Base Neutrals	21	4	---	---	25
4) Pesticides and PCBs	17	3	---	---	20
5) Volatile Organic Compounds	109	107	---	---	216
6) Total Non-Methane Organic	---	---	---	65	65
7) Volatile Organic Compounds (Air)	---	---	---	69	69
Total of All Categories					609
Spring Sampling Period					
1) Conventional and Process	73	---	---	---	73
2) Metals	12	8	5	---	25
3) Acid and Base Neutrals	6	---	---	---	6
4) Pesticides and PCBs	12	6	6	---	24
5) Volatile Organic Compounds	17	17	---	---	34
6) Total Non-Methane Organics	---	---	---	---	
7) Volatile Organic Compounds (Air)	---	---	---	---	
Total of All Categories					162

6.2 FLOWS AND LOADS

6.2.1 INTRODUCTION

This section sets forth the results of investigations concerning projected wastewater flows and loadings for the new Deer Island Secondary Treatment Plant. The wastewater and associated pollutants received at the MWRA's treatment facilities originate from a variety of sources: domestic wastewater associated with residential activities; nondomestic wastewater associated with the commercial, industrial, institutional, and other business activities of the region; infiltration and inflow; and stormwater flow. Infiltration and inflow is water other than domestic and nondomestic wastewaters that enters sewers unintentionally, and results from the effects of age, condition, and location of the sewer pipe. Stormwater flow is the flow that results from the combined systems that carry both wastewater and street drainage, and is intentionally allowed into the sewer system.

This section characterizes the conventional pollutant loading to the new plant, as well as biochemical oxygen demand (BOD) and total suspended solids (TSS). This section also sets forth the characterization of nonconventional pollutants. The non-conventional pollutants categories are: metals; ABNs; pesticides and PCBs; and VOCs.

6.3 FLOW ESTIMATES

6.3.1 GENERAL

The volume of wastewater produced in the Authority's service area is directly related to the following factors:

- the sewered population of the service area and the volume of water used by the residents and returned to the sewer system as domestic wastewater.

- the economic activity taking place within the service area which drives area growth and employment and thus the volume of nondomestic wastewater discharged as a result of commercial, industrial, manufacturing and employee usage.

- the rainfall in the service area, which enters the sewer system as infiltration/inflow or as direct stormwater flow, and the groundwater levels in the service area which, when high, add to the volume of infiltration/inflow.

Projections through the year 2020 for each of the sources of wastewater flows are set forth in this section.

6.3.2 DOMESTIC WASTEWATER

The volume of domestic wastewater is a function of the population of the service area, the water use patterns of the residents, and the amount of water used and returned to the sewer system.

The service area is divided into two areas: the North System (tributary to the Deer Island Plant) and the South System (tributary to the Nut Island Plant).

The Deer Island Facility, in operation since 1968, serves twenty-six communities. The area served by this treatment plant is approximately 170 square miles, with a total population of approximately 1,300,000 and a contributing population of approximately 1,250,000. Member cities and towns include:

Arlington	Lexington	Stoneham
Bedford	Malden	Wakefield
Belmont	Medford	Waltham
Boston (Part of)	Melrose	Watertown
Brookline (Part of)	Milton (Part of)	Wilmington
Burlington	Newton (Part of)	Winchester
Cambridge	Reading	Winthrop
Chelsea	Revere	Woburn
Everett	Somerville	

The Nut Island Facility has been in operation since 1952 and currently serves twenty-one communities. The southern system encompasses an area of approximately 240 square miles and currently has a total population of approximately 750,000 and a contributing population of approximately 650,000. Member cities and towns include:

Ashland	Hingham, (N. Sewer Dist.)	Quincy
Boston (Part of)	Holbrook	Randolph
Braintree	Milton (Part of)	Stoughton
Brookline (Part of)	Natick	Walpole
Canton	Needham	Wellesley
Dedham	Newton (Part of)	Westwood
Framingham	Norwood	Weymouth

The service area will be limited to the communities now named in the Authority's enabling legislation. Only a few small communities at the edge of the Authority's service area, as shown in Figure 6.3.2-1, are not now served by wastewater collection and treatment facilities and could be considered potential additions to MWRA's service area. Including these surrounding communities would, however, be inconsistent with MWRA's enabling legislation and with the MWRA's Board of Director's stated intentions regarding future flows and load increases to the Deer Island Facility. Section 8 e of MWRA's enabling legislation requires the following before a municipality may be added to the sewer service territory:

1. The approval of the Governor and the General Court.

2. The approval of the MWRA's Advisory Board.



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FIGURE 6.3.2-1
AREA SERVED BY THE MWRA SEWERAGE SYSTEM AND ADJACENT AREAS SERVED BY OTHER WASTEWATER UTILITIES

3. The approval of the Department of Environmental Quality Engineering, which shall be given only after due consideration of feasible alternatives.

4. A finding that the safe capacity of the sewer system as extended will be sufficient to meet ordinary wet-weather demand.

5. A finding that all feasible actions have been taken and shall continue to be taken to minimize infiltration and inflow.

6. A finding that an industrial pretreatment program is in effect in accordance with applicable laws and regulations.

Additionally, the MWRA Board of Directors, as part of their siting decision for the wastewater treatment plant, clearly stated that it was their intention to limit the flows and loads to the facility. The Board voted that the Deer Island facility would not be expanded beyond its initial design capacity until and unless all feasible alternatives -- including satellite treatment facilities -- had been fully pursued.

Present Population

Residential population, as defined by U.S. Census data, includes standard population as well as students in dormitories and other institutional residents. U.S. Census estimates from July of 1984 showed about 2,046,000 residents within MWRA's service area.

Population Projections

Most population forecasting models study previous trends of growth and extrapolate these trends into the future. Many of these models assume that the future population of a community reflects past growth of that community, past growth of some other community, or growth of the region. The true causes of these past trends in population change are natural change and migration. Natural change is composed of births and deaths. Migration reflects the effect of individuals moving into an area less the number moving out of the area. Some population models incorporate the importance of economic factors in establishing migration patterns.

Projections for the residential population in the MWRA service area were based on the review of two regional forecasts listed below:

- Metropolitan Area Planning Council (MAPC)
  Regional Decline or Revival: An Interim Population Forecast for the Boston Metropolitan Area 1980-2010 (1982).

- Metropolitan District Commission (LRWSS)
  Water Supply Study and Environmental Impact Report 2020: Water Demand Projections (1983)

The basis of each forecast is described below:

Metropolitan Area Planning Council (MAPC). The MAPC forecasts were prepared in 1982 to the year 2010 and include 101 communities in eastern Massachusetts. All of the 43 communities in the MWRA service area are included in the MAPC boundary. Review of the regional planning agency population projections is consistent with the required approach to facilities planning population projections set forth by EPA.

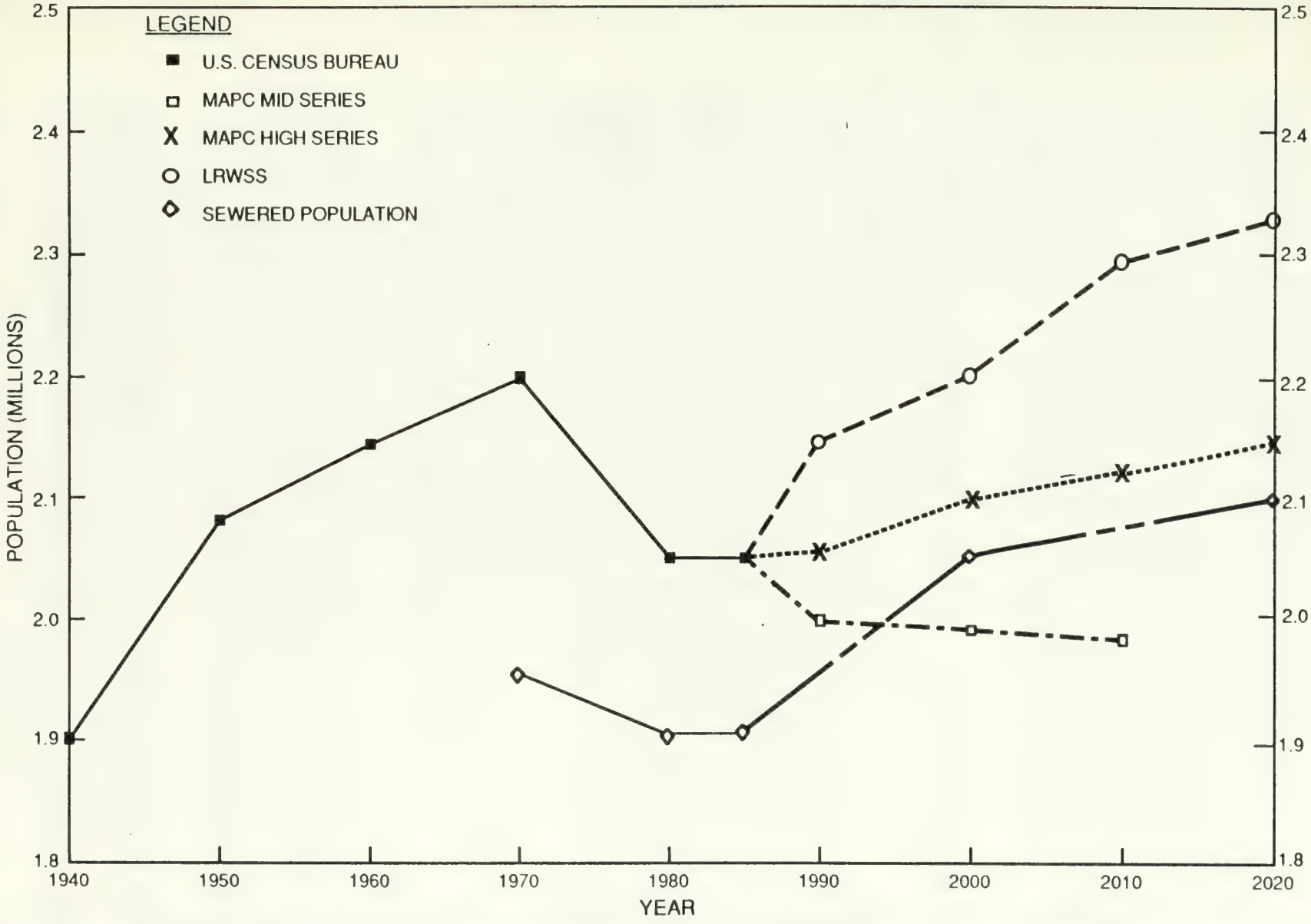
The MAPC model focused on the reformulation of the area's population into smaller household units, including one-parent families and persons living alone. Other factors influencing the analysis included: the shift of women, especially married women, into paid employment; the transformation from manufacturing to a services-based economy and its effects upon family income; the diffusion of workplace and residence to more suburban locations; the continuance of net migration, but at a reduced rate; and the housing prices in the area.

The MAPC has formulated three growth scenarios for the region: low series, mid series and high series, reflecting differing perspectives on future trends in the underlying variables. The mid series projections implicitly assumed that natural increase and net migration would operate in such a manner that the population of the MAPC region would remain the same over time. However, shifts of population would occur within the region. The high and low series project increases and decreases in population of 8 percent compared to mid-series population projections by 2010. The high series was based on an increase in fertility and a net migration of zero, while the low series reflected decreased fertility and higher rates of migration than were assumed in the mid-series estimate.

Long Range Water Supply Study (LRWSS). The population forecast set forth in the LRWSS, as prepared in 1983 for the Metropolitan District Commission, was also reviewed for this study. The forecast was based on the Massachusetts Economic Policy Analysis Model developed by the University of Massachusetts, which reflects a direct relationship between the demographic and economic factors of the area. The forecasts are based on the assumption that it is the characteristics of the region's evolving economy (industry composition, business costs, shifting employment, etc.) that will determine the region's future and, through migration, its ultimate population. Important aspects of this model are that it is practically unhindered by past migration patterns and that it focuses on current and projected employment trends as well as the migration patterns associated with those trends.

The study area of the LRWSS consists of a total of 80 communities (44 current MWRA water users and 36 potential future users). Five communities within the MWRA sewer service area (Burlington, Hingham, Reading, Walpole, and Weymouth) were not included in the LRWSS study area. Population figures for these communities were based on estimates developed in previous facilities planning studies.

Conclusion. Figure 6.3.2-2 shows the total MWRA service area population since 1940, along with the MAPC mid- and high-series population forecasts and the LRWSS forecast. The population projected by LRWSS is approximately 8 percent greater than the MAPC high series model.



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FIGURE 6.3.2-2
POPULATION PROJECTIONS FOR MWRA SEWERED SERVICE AREA

For the purposes of this report, we have adopted the MAPC high series total population projections of 2.10 million for the year 2000 and an extrapolated estimate of 2.15 million for the year 2020. The Massachusetts and Boston Metropolitan areas are now going through a change in their underlying economic structure with an inherent uncertainty in the relationship of employment, population, and industrial output. The MAPC model deals with this level of uncertainty to a greater degree than the others because it does not assume that employment in a region forces the population projection for that region. The MAPC high series population projection also provides for recognition of growth in the region that is not factored into the mid-series projections. The LRWSS econometric model relies more heavily on the assumption that people live where they work. This assumption is reflected in their higher population projections for 2020.

The sensitivity of this population projection to decisions on wastewater flows is explored in Section 6.3.7.

Sewered Population

Based on the 1984 MDC Annual Report, approximately 1.9 million people, or 92 percent of the total population in the service area, were connected to the sewer system. In member communities that are partially sewered, both population changes and projected sewer system extensions have been incorporated in the sewered population projections. As shown in Figure 6.3.2-2, it has been assumed that approximately 98 percent of the total projected population, or 2.1 million people, will be sewered in the design year. Not all residents in every community will have sewer service because of cost considerations (construction costs are high for remote areas, and there are high connection and annual charges in areas with existing sewers). Conservatively, it has also been assumed that 98 percent of the total population will be sewered in the year 2000.

Domestic Wastewater Projections

Estimated flow rates of domestic wastewater have been prepared using the residential population projections and estimated water consumption rates of the domestic sector.

The LRWSS included a detailed analysis of domestic water consumption using 1980 actual consumption data. Average daily domestic per capita water use in the region was found to range from 50-200 gallons per capita per day (gpcd), which is primarily a function of housing type (ie. single family vs.multi-family, small lot vs. large lot) and the number of persons per household. The current average domestic water consumption rate in the MWRA service area was estimated at 76 gpcd. This estimate includes a 6 percent allowance for the under-registration of domestic meters as estimated by the LRWSS.

The LRWSS estimated that approximately 12 percent of the domestic consumption was seasonal use such as lawn watering, filling of pools, etc.; this water was not returned to the system. The report also estimated that approximately 22 percent of the domestic consumption was non-sanitary, such as laundry, dishwashing, and cooking. Based on this estimate, an additional

3-percent of the total domestic water consumption was not returned to the sewer system. Thus, 85 percent of the domestic water used is expected to be discharged to the sewer system as domestic wastewater, or 65 gallons per capita per day.

The LRWSS projected a small reduction in domestic consumption in future years, primarily as a result of plumbing code revisions, increased user charges, and conservation efforts. Because the projected reduction in consumption is small, the future per capita consumption used to estimate future domestic wastewater flows from residential sources is assumed to be the same as observed in the 1980 data. The sensitivity of this projected flow rate to the total wastewater flow projection is analyzed in Section 6.3.7.

Future domestic wastewater flows from residential sources were estimated by applying a per capita wastewater contribution of 65 gallons per capita per day (85 percent of the expected per capita water consumption) to the sewered population projections, summarized in the previous section. Thus, the total estimated domestic wastewater expected from residential sources is 133 mgd and 136 mgd in the years 2000 and 2020, respectively.

6.3.3 NONDOMESTIC WASTEWATER PROJECTIONS

Nondomestic wastewater is contributed to the Authority's system from the business activities that take place within the service area. These include process wastewater associated with manufacturing activities, institutional activities, employee-related sanitary wastes, and wastes that are incidental to the service provided by the business. An example of the latter category is the wastewater produced by visitors to the region who occupy hotel rooms.

Estimated volumes of wastewater have been projected over the planning period by subdividing the nondomestic user class into two categories, major and minor, and projecting the contribution from each class separately. The major category is comprised of the 667 major users of the Authority's system. Records of these users are available from the Authority's Industrial Waste Control program files. The minor users are generally commercial business, office buildings and service companies. Estimates of flows from those users have been based on predicted employment in the service area.

Major Nondomestic Users

Data for flows from major nondomestic users has been taken from the 1985 industrial waste records of the Authority. This information is collected by the Authority for use in the pretreatment program, and as part of the Authority's sewer use charge billing system. The types of companies included in the major category include manufacturing establishments, large institutional users, such as hospitals and schools, and large service companies such as laundries.

Based on the LRWSS and previous facilities planning reports prepared for the MWRA service area, the rate of wastewater flow for the major nondomestic users in the year 2020 has been projected to remain constant at the 1985 discharge level of 43 mgd. Water intensive industries are not

expected to move into the region -- indeed the opposite has been true, as recently seen in a decline in water-intensive manufacturing such as leather tanning and textile processing. It is generally anticipated that companies will be under pressure to minimize water use, primarily because of high water and sewer charges. However, it cannot be assumed that all of the major users were at optimum production levels in 1985. Thus, while some existing users may decrease the wastewater discharge rates below existing levels, others may increase above existing levels in response to increased demand for their goods and services, and new discharges may be added.

Minor Nondomestic Users

The category of minor nondomestic users includes all other business activities that take place in the service area. Unlike the major nondomestic category, which includes a substantial flow component associated with the manufacturing process, the wastewater contribution of the minor nondomestic category is predominantly driven by employee usage. Thus, future levels of minor nondomestic flows have been projected based on future employment in the Authority's service area and assumptions concerning employee water use patterns. While there are limitations in stating a "gallon per employee" figure for wastewater discharge, such a number can be related to employment statistics, and employment projections can be related to project wastewater discharge.

Existing employment for the minor nondomestic class of dischargers has been estimated using employment information collected by the Massachusetts Division of Employment Security (DES), and data on employment of the major nondomestic users available through the Authority's Industrial Waste Program. The difference between the two represents the estimated existing minor nondomestic users. The DES data were adjusted upward by 8 percent to include workers not covered under the Employment Security Act. Current (1985) adjusted DES information shows about 1,432,000 employees working in the service area. Major company employment for the same year has been estimated at 335,000 employees, leaving 1,097,000 as the 1985 estimated minor company employment.

Projections of future employment in the service area have been estimated based upon assumed rates of growth of the economy of the service area presented in previous studies.
Future levels of employment within the greater Boston metropolitan area have been projected by several different organizations. The Boston Edison Company (BECo) has recently forecast employment for its service district through the year 2000. The BECo Service District, which comprises 47 municipalities in the Greater Boston area, overlaps much of the MWRA's sewer service area. Of the 43 communities served by the Authority, 28 are also included in the BECo service territory. The major differences between the service areas exist in the northeast, southeast, and in the western boundaries of the MWRA's service area. Overall, BECo has projected a total increase in employment of approximately 40 percent between 1985 and the year 2010.

The Massachusetts Division of Employment Security has recently forecast changes in employment for the state as a whole through the year 1995. These projections indicate an increase in statewide employment of approximately 15 percent over 1985 employment. Additionally, Arthur D. Little, as part of the LRWSS studies, prepared employment forecasts through the year 2020 for

the state as a whole and for various subregions of the state. These forecasts predicted an increase in statewide employment of approximately 20 percent between 1980 and the year 2000, and an additional 21 percent between the years 2000 and 2020.

Since the Arthur D. Little forecast is the only estimate for MWRA and estimates of employment through the year 2020, the results of that study have been adopted for this report.

Adjustments have been made to the forecasted employment to reflect the actual 6.5 percent growth in employment in the MWRA service area that occurred between 1980 and 1985. Accordingly, from 1985 through 2020 it is expected that employment will rise by 30 percent over 1985 levels. Minor company employment is estimated to be 1,426,000 in the design year.

The wastewater contributions associated with total employment in the year 2020 have been based on an allowance of 30 gallons per capita per day for all employees except those engaged in the hotel and food services businesses. For these last two classes of business, which comprise about 1.5 percent and 7 percent of the employment in the region respectively, special allowances have been made to account for the water-intensive nature of the business. Allowances of 150 gal/employee/day for hotels and 180 gal/employee/day for food service have been used for projecting flows. Minor nondomestic flows are estimated at 46 mgd, 50 mgd and 60 mgd respectively in the years 1985, 2000 and 2020.

The average base domestic and nondomestic wastewater projections for the years 1985 to 2020 are shown in Table 6.3.3-1.

6.3.4 INFILTRATION AND INFLOW

The Massachusetts Water Resources Authority treatment facilities receive flow from approximately 230 miles of Authority sewers and 5400 miles of municipal sewers in the 43 communities served by the Authority. These sewers are of varying sizes, shapes, age, materials, depths, and conditions, but have one common characteristic: they all contribute some degree of infiltration and many contribute some inflow. Infiltration and Inflow (I/I) is the clear water entering the sewer systems of both MWRA and its contributing communities through leaking pipes, catch basins, house connections, roof leaders, manhole covers, sump pumps, and tide gates. Additionally, the sewer systems of several communities, Boston, Brookline, Cambridge, Chelsea, and Somerville, were built many years ago with the express purpose of being capable of receiving both wastewater and stormwater. These sewers are referred to as "combined" sewers and are no longer allowable for new construction. The remainder of the system comprises "separate" sewers intended to only carry wastewater.

Certain levels of infiltration are expected in any system. Poor sewer construction techniques and practices, together with system deterioration, cause infiltration levels to rise. In some areas, sump pumps, roof leaders, and catch basins are illegally connected to separate sewers contributing significant inflow. High levels of I/I cause capacity problems within the collection system, since I/I usurps capacity which would otherwise be available to transmit wastewater. The result is back-up into homes, local overflows of untreated wastewater, and increased operating costs.

TABLE 6.3.3-1

EXISTING AND PROJECTED AVERAGE DAILY WASTEWATER FLOWS (mgd)

	1985	2000	2020
Domestic	123	133	136
Nondomestic			
Minor Users	46	50	60
Major Users	43	43	43
Total	212	226	239

Notes:

1) Domestic wastewater flow based on sewered population and wastewater production of 65 gpcd.

2) Minor nondomestic wastewater flow based on employment trends with wastewater production of 30 gallons per employee per day for all employees except those engaged in the hotel and food service businesses.

3) Major nondomestic wastewater flow assumed static over the planning period.

Infiltration and inflow does not contribute any significant organic and solids loadings to the treatment facilities. However, I/I will contribute a very significant portion of the total flow to be treated at the plant and will directly affect the capital and operating costs. The capacity of new pumping facilities, preliminary and primary treatment, secondary clarifiers and disinfection basins is based, to a significant extent, on the allowance included for I/I.

I/I, particularly infiltration, has been found to vary seasonably with the level of groundwater throughout the service area. Flows to the Authority's headworks and treatment facilities have historically been higher during the spring, reflecting generally higher groundwater conditions than during the remainder of the year. Therefore, for this report, I/I flows were estimated for two periods: high groundwater conditions (February - May); and low groundwater conditions (June - January). To determine the magnitude of I/I in the MWRA system, historic flows entering the Deer Island and the Nut Island Plants were examined separately.

North System

Estimation of I/I flows in the North service area is complicated by several factors. First, a portion of the service area has combined sewers, so analysis of total flows by the components of wastewater, I/I, and stormwater runoff is difficult. Second, the Deer Island Main Pumping Station that pumps most of the flow to the Deer Island plant has been operating with reduced capacity since the late 1970s. For extended periods the plant has had only five of nine pumps available. This requires wastewater flows to be "choked" at the headworks facilities under high flow conditions, resulting in overflows at combined sewer overflow (CSO) treatment facilities and other overflow points and backup in sewers. Therefore, records of flows at the headworks and the treatment plant are not reliable indicators of total plant flow and require adjustments for estimating I/I flows.

The following method was used to determine I/I during low groundwater conditions. The average daily flows obtained from the Deer Island plant records for the months of June, 1984 through January, 1985; June, 1985 through January, 1986; and June, 1986 through January, 1987 were examined. Flow during these low groundwater months averaged about 260 mgd at Deer Island. Data from days without rainfall were used to exclude storm flows. Since average domestic and nondomestic wastewater flows were estimated at about 134 mgd, the difference of 126 mgd was estimated to be the I/I component.

To determine I/I during maximum conditions, the monthly average maximum daily flows for the same periods were examined. The average maximum daily flow was 292 mgd. Subtracting the 134 mgd of wastewater flows results in a maximum I/I flow of 158 mgd which was also used as the peak hour I/I rate. Peak hour rates are also influenced by direct inflow caused by storm events. In the North System inflow from combined sewer areas results in sewers becoming full, causing CSOs. The stormwater component of flows will be discussed in a later section.

Periods of high groundwater stormflows cause plant bypasses so that total wastewater flows are under-recorded at Deer Island. To calculate the average amount of I/I during high groundwater

conditions, a method was developed to adjust Deer Island flow data to take into account system bypasses. During the spring of 1984, wastewater flow to Deer Island on days without rainfall was approximately 380 mgd. During those days about 312,000 lb/day of total suspended solids reached the plant. During the fall of 1984, approximately 350,000 lb/day of total suspended solids reached the plant on days without rainfall. Therefore, about 40,000 lb/day of total suspended solids or about 12 percent of the organic loading to the plant was not reaching the plant during spring conditions.

On the basis of this analysis, the spring average daily flow was adjusted by about 12 percent to 420 mgd to represent the flow that would have reached the plant without bypasses. The I/I flow was determined by the difference between the adjusted total flow, 420 mgd, and the base wastewater flow of 134 mgd. This results in an average day high groundwater period flow of 286 mgd, or slightly more than twice the average I/I flows during low groundwater conditions. Maximum day (non-storm) high groundwater I/I flows were determined by examining monthly average maximum daily flows adjusted for the flow not reaching the plant as described above. The adjusted maximum daily flow to Deer Island was 524 mgd during the spring of 1984. Subtracting the 134 mgd of wastewater flow results in a maximum I/I flow of about 390 mgd. As noted earlier, infiltration rates respond to groundwater levels and, therefore, do not change significantly from day to day. Inflow, however, varies with the magnitude of storm events, changing considerably from day to day and significantly from hour to hour during storms. Because the amounts of I/I are not known on an individual basis in the North System, peak-hour and maximum-day I/I quantities were taken to be equal. Existing average and maximum/peak hour I/I flows for the North and South service areas for both low and high groundwater conditions are shown in Table 6.3.4-1. Later in this section, the actual amount of I/I to be accepted at the Deer Island Plant will be established.

South System

The South service area represents all the service area tributary to the Nut Island plant. The South System has only a small percentage of combined sewers, but data from the Nut Island plant show that storm events cause large increases in flows to the plant. The Nut Island plant has an influent pumping station with a rated capacity of about 280 mgd. However, firm capacity of the pumping station is less than this amount. When flows exceed the available pumping capacity, the excess is bypassed. The bypassed quantities historically have not been recorded, but recent flow measurements show the bypasses to be substantial during major storm events.

To determine the I/I contribution during low groundwater conditions (June to January), plant records from 1984 through mid-1987 were examined. Average daily flows were about 100 mgd. Based on estimates of connected population and major and minor nondomestic contributions, the wastewater flow during that period was approximately 75 mgd. The difference between the total (100 mgd) and the wastewater flow (75 mgd) of 25 mgd and was taken to be the average I/I during periods of low groundwater conditions. Maximum and peak hour I/I flows were based on data from the recently completed South System Modeling Study conducted for MWRA and described below.

For high groundwater conditions, data for three wet springtime months were analyzed (March and April, 1984 and April, 1987). Average daily non-rainfall flow during this period was 220 mgd.

TABLE 6.3.4-1

ESTIMATE OF BASEFLOW INFILTRATION AND INFLOW FOR NORTH AND SOUTH SERVICE AREAS (mgd)

Low Groundwater Conditions

	Average	Maximum Day	Peak Hour
North Service Area	126	158	158
South Service Area	25	115	180
Total	151	273	338

High Groundwater Conditions

	Average	Maximum Day	Peak Hour
North Service Area	286	390	390
South Service Area	145	235	300
Total	431	625	690

Subtracting the wastewater flow (75 mgd) results in an estimated average I/I flow of 145 mgd. Maximum and peak hour I/I flows cannot be estimated from the plant data because of bypasses. Therefore, data from the South System Modeling Study were used.

Since June, 1986, flow meters have been placed at a number of locations in the HLS, and on several occasions storm conditions have caused surcharging along the HLS. The Division of Water Pollution Control (DWPC) has established a "design storm" for determining the cost-effectiveness of I/I removal. The storm has a duration of 6 hours, a recurrence interval of one year, and produces a rainfall of 1.7 inches. The area tributary to the HLS was modeled by Metcalf & Eddy using the DWPC's design storm. The total routed inflow averaged about 90 mgd over a one-day period. The peak inflow during the period was 155 mgd. To estimate the total flow at Nut Island during a design storm, two conditions were evaluated in this facilities plan.

For the first case, a future average daily flow of 85 mgd was used. The design storm was assumed to occur at such a time that the maximum rate of inflow (155 mgd) occurred at the peak hour of wastewater flow (120 mgd). This is shown graphically in Figure 6.3.4-1. The average daily flow during the day of a design storm would be about 320 mgd. However, the maximum rate of flow experienced at Nut Island would range up to 420 mgd.

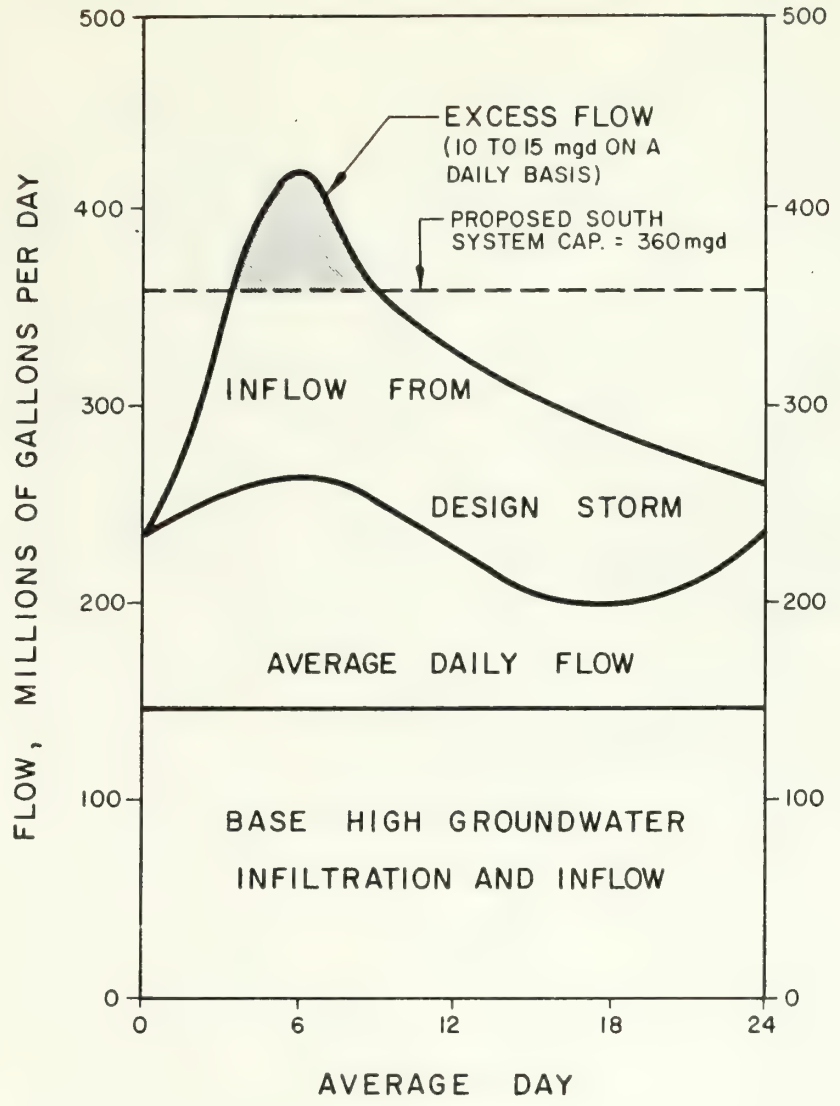
For the second case, a maximum daily flow of 120 mgd was used. This worst-case senario assumed that in any one year the design storm occurred on the same day as the maximum domestic and nondomestic flows. Also, the design storm was assumed to coincide with a peak hourly flow rate of 170 mgd. The resulting flows are also shown in Figure 6.3.4-1. The average daily flow to Nut Island for this case would be about 355 mgd. The maximum rate of flow would be 470 mgd. For both case 1 and case 2, the high groundwater baseflow I/I of 145 mgd was used. During low groundwater conditions, the design storm does not result in any excess flows.

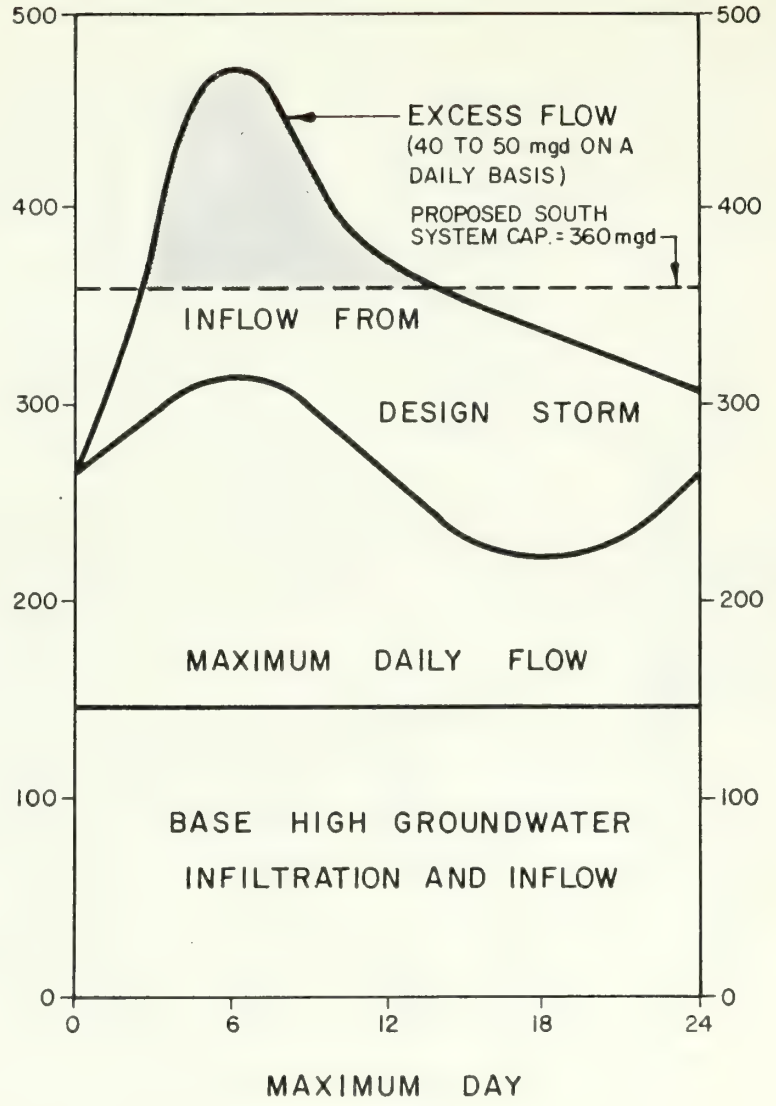
Table 6.3.4-1 summarizes I/I flows for both low and high groundwater conditions. For low groundwater conditions, average I/I was estimated to be 25 mgd. The maximum day I/I of 115 mgd was based on average I/I plus 90 mgd of storm-induced inflow. The peak hour I/I of 180 mgd was based on average I/I plus 155 mgd of storm-induced inflow.

For high groundwater conditions, average I/I was estimated to be 145 mgd. The maximum day I/I of 235 mgd was based on average I/I plus 90 mgd of storm-induced inflow. The peak hour I/I of 300 mgd was based on average I/I plus 155 mgd of storm-induced inflow.

Infiltration and Inflow Summary

Base wastewater flows (domestic and nondomestic) for the year 2020 were added to I/I flows to determine the non-storm wastewater flow to the plant. Stormwater flows will be discussed in the next section. In the North System, the transmission system was originally sized to accept storm flows so that all nonstorm flows will reach Deer Island with a considerable amount of additional capacity available for storm conditions. Table 6.3.4-2 shows North System flows without stormwater.





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FIGURE 6.3.4-1

ESTIMATES OF EXCESS FLOW IN SOUTH SYSTEM

TABLE 6.3.4-2

DESIGN YEAR
NORTH SYSTEM FLOWS (mgd)

	Average	Maximum Day	Peak Hour
Low Groundwater Conditions			
Wastewater	154	208	246
I/I	126	158	158
Total	280	366	404
High Groundwater Conditions			
Wastewater	154	208	246
I/I	286	390	390
Total	440	598	636

Table 6.3.4-3 shows South System flows for low and high groundwater conditions. At low groundwater conditions all flows reach Nut Island. However, at high groundwater conditions, peak hour wastewater flows coupled with the storm inflow exceed the capacity of the HLS. The South System Modeling Study determined that the HLS has a maximum hydraulic capacity of 360 mgd without surcharging.

The 360 mgd capacity is greater than the present capacity of the HLS because the downstream end of the HLS is restricted by the elevation and capacity of the existing Nut Island treatment plant. The new headworks facility will remove these restrictions and increase the HLS capacity from about 310 mgd to 360 mgd. As shown earlier, designing the new facilities for a maximum flow of 360 mgd results in excess flows only during certain periods of time. During high groundwater conditions and storm events the peak-hour excess flow rate is about 110 mgd. During the day the design storm occurs, it will be necessary to reduce inflow by 40 to 50 million gallons to eliminate surcharging of the HLS. At maximum day during high groundwater conditions there will be no excess flow -- all flows will pass through the new Nut Island headworks facilities.

Infiltration and Inflow Removal

In the previous section it was shown that during average conditions I/I will amount to 151 to 431 mgd, depending on the time of the year. This represents from about 40 percent to about 65 percent of the total average flow to the plant for low groundwater and high groundwater periods, respectively. Conveyance and treatment of this flow is costly, and as shown, contributes to system surcharging during storm events. These estimates are based on the best available information and reflect the configuration and age of existing sewers. As the system ages and as new sewers are constructed, I/I amounts will increase. An ongoing rehabilitation program for repair as replacement of old sewers must be undertaken to ensure that I/I allowances do not excess system capacity. Such a program is a basic assumption in the development of these estimates and is discussed below.

MWRA is committed to develop and implement an I/I reduction policy and program. A comprehensive policy and program is now being developed by MWRA, and will be submitted to the DWPC as an integral part of the Facilities Plan. One element of the program is system-wide metering. A South System Modeling Program has already been completed. An expanded program including the North System and monitoring stations is presently being developed. The interim phase is scheduled to be on line by November, 1988, and the permanent phase by Spring, 1991.

Another major program element is the development of a consistent data base and project review procedures for existing I/I studies. Such an effort has been accomplished for the South System under a DWPC study but needs to be done for the North System as well.

Table 6.3.4-4 shows estimated amounts of I/I in the MWRA system. Data from the South System are based on existing studies described below. However, data from the North System are based on a survey conducted for this study. The data have not been evaluated and developed into a common base similar to the South System's. For both the North and South Systems, the estimates do not include I/I into the Authority's interceptors themselves.

TABLE 6.3.4-3

DESIGN YEAR
SOUTH SYSTEM FLOWS (mgd)

	Average	Maximum Day	Peak Hour
Low Groundwater Conditions			
Wastewater	85	120	170
I/I	25	115	180
Total	110	235	350
High Groundwater Conditions			
Wastewater	85	120	170
I/I	145	235	300*
Total	230	355	470

*Before I/I reduction, see text.

TABLE 6.3.4-4

PRELIMINARY ESTIMATES OF EXISTING INFILTRATION AND INFLOW BY COMMUNITY

North System[1]	Peak I/I (mgd)		Peak I/I (mgd)
Arlington	12.4	Milton	0.2
Bedford	2.2	Newton	21.6
Belmont	8.0	Reading	2.5
Boston[2]	43.5	Revere	12.2
Brookline	2.5	Somerville[2]	5.3
Burlington	9.9	Stoneham	4.2
Cambridge[2]	21.6	Wakefield	5.8
Chelsea[2]	10.0	Waltham	11.1
Everett	29.4	Watertown	14.7
Lexington	6.6	Wilmington	2.3
Malden	2.1	Winchester	11.3
Medford	18.0	Winthrop	5.4
Melrose	4.3	Woburn	11.4
		TOTAL (Rounded)	278

South System[3]	Peak I/I (mgd)		Peak I/I (mgd)
Ashland	0.6	Natick	3.0
Boston	100.0 to 120.0	Needham	10.8
Braintree	7.4	Newton	14.8
Brookline	19.6	Norwood	6.8
Canton	5.2	Quincy	22.4
Dedham	10.4	Randolph	2.5
Framingham	6.6	Stoughton	5.2
Hingham	6.0	Walpole	3.4
Holbrook	0	Wellesley	7.9
Milton	2.9	Westwood	2.5
		Weymouth	20.6
		TOTAL (Rounded)	260 to 280

Notes: [1] North System estimates based on survey conducted for this study (see text).

[2] These communities have combined sewers. I/I estimates are infiltration only.

[3] Estimates are based on RJN Engineers Study for MADWPC, except Boston estimate, which was supplied by BWSC.

The sewer systems in all 21 communities in the South System are currently being studied by RJN Engineers, under a DEQE contract. The study is evaluating all of the previous I/I studies conducted by these communities during the last 10 years. These studies were prepared using different definitions, design storms, periods of flow measuring, percent of individual community studied, and transport and treatment costs to assess the cost effectiveness analysis of I/I reduction programs. RJN is summarizing this information into a common data base. The Boston Water and Sewer Commission (BWSC) is also conducting a comprehensive I/I identification and reduction program in the portion of the city lying within the South System service area.

The final RJN study results and BWSC study results are not available. However, preliminary results have identified approximately 260 to 280 mgd of I/I from the 21 communities in the South System. Approximately one-half of this flow is infiltration.

National studies have shown that infiltration reduction programs typically remove less than 15 percent of infiltration to sewers. However, based on experience in other municipalities, inflow is much easier to remove, especially if it is found to be from public sources. It is reasonable to expect 50 percent or greater removal of identified inflow.

More studies are required before it will be possible to determine the exact amount of I/I present in the South System and the amount of I/I that can be removed. However, it is reasonable to expect that sufficient I/I can be removed to eliminate the excess flows from the South System so that no more than 360 mgd reaches the new Nut Island headworks.

6.3.5 STORMWATER

Within the communities of Boston, Brookline, Cambridge, Chelsea, and Somerville are approximately 12,900 acres with combined sanitary and storm sewers. During storms, runoff reaches the plant via these combined sewers. Stormwater runoff in excess of the transmission capacity of the sewer system is discharged to nearby water bodies as combined sewer overflow (CSO). The maximum capacity for headworks receiving stormwater runoff, and for the proposed headworks at Nut Island serving the South System service area, is shown below.

Transmission System Capacity (mgd)

Ward Street	256
Columbus Park	182
Chelsea Creek	350
Winthrop Terminal	125
Subtotal North System	913
Subtotal South System	360
Total	1273 (rounded to 1270 in subsequent tables)

As shown in Table 6.3.5-1, maximum daily non-storm flows will range from 600 mgd to 950 mgd, depending on the time of the year. Since the maximum hydraulic capacity of the transport

TABLE 6.3.5-1

SUMMARY OF AVERAGE DAILY (NONSTORM) FLOW BY YEAR (mgd)

	1985	2000	2020
Total Population	2,050,000	2,100,000	2,150,000
Sewered Population	1,900,000	2,060,000	2,100,000
Domestic Wastewater	123	133	136
Nondomestic Wastewater			
Minor Users	46	50	60
Major Users	43	43	43
Subtotal	212	226	239
Infiltration/Inflow (Low Groundwater Conditions)	151	151	151
Total	363	377	390
Infiltration/Inflow (High Groundwater Conditions)	431	431	431
Total	643	657	670
Average Annual Conditions	460	470	480

system is approximately 1270 mgd, then from 320 to 550 mgd of capacity will be available to accept stormwater flows in the North System at maximum day wastewater flow conditions.

This facilities plan assumes that the Deer Island Plant will play a significant role in the Authority's future program to manage CSOs. A 1982 CSO Facilities Plan recommended decentralized storage and additional treatment facilities located throughout the service area. The recent CSO facilities planning envisions deep storage tunnels and pumpback of stormflows to the plant. Preliminary estimates of pumpback rates are 200 to 300 mgd for a one- to two-day period following a major storm. For this facilities plan the treatment plant will be designed to accept up to 1270 mgd, the capacity of the transmission system. This means that stormwater flow rates of up to 550 mgd can be accommodated depending on the time of the year. Thus, for the present, the proposed plant capacity is adequate for preliminary CSO return flows. The impact of CSOs on the plant will be reevaluated during plant design after definitive estimates are available from the CSO facilities plan.

6.3.6 TOTAL WASTEWATER FLOWS

As shown in Table 6.3.5-1, average daily flow during low groundwater conditions at design year is estimated at 239 mgd. Including infiltration and inflow, the total average daily flow during low groundwater conditions is estimated at 390 mgd. At high groundwater conditions, the flow is estimated to average 670 mgd. Assuming a four-month period of high groundwater and an eight-month period of low groundwater, the annual average flow during non-storm events is approximately 480 mgd. Table 6.3.6-1 shows design year average, maximum and peak hour flows under both low groundwater and high groundwater conditions. Also shown in this table is the total capacity in the transmission system and the treatment facilities available for stormwater flow under the various conditions.

6.3.7 SENSITIVITY ANALYSIS

The flow estimates presented in the previous sections were developed from the best available data. The sensitivity of variations in these estimates and their effects on plant sizing and performance were analyzed.

Wastewater flow estimates for the domestic sector were based on the regional population projections for the service area, combined with estimated per capita water consumption. The domestic wastewater flow represents about 29 percent of the total average day flow in the year 2020. Therefore, variations in domestic flows will not significantly affect total flow arriving at the plant. The sewered population projection could vary if additional outlying communities become members of the MWRA sewer district (i.e., Lynnfield in the North System and Dover, Sharon, Sherborn, and Southborough in the South System). The estimated additional sewered population in 2020 is no more than 5,000 for the North System and 14,500 for the South System. These represent about an additional one percent in the total service area population. Applying the per capita wastewater production rate of 65 gpcd results in only an additional 1.3 mgd. Increasing the projected population for the entire service area by 8 percent, representing the LRWSS population estimate, results in an increase of only 11 mgd over the annual average of 480 mgd. According to the LWRSS, reduction in domestic wastewater flow due

TABLE 6.3.6-1

DESIGN YEAR (2020) FLOWS (mgd)

	Low Groundwater Conditions			High Groundwater Conditions		
	Average	Maximum	Peak Hour	Average	Maximum	Peak Hour
Non-Storm Conditions						
Total Flow	390	600	750	670	950	1000
Storm Conditions						
Wastewater Flow	390	600	750	670	950	1000
Capacity For Stormwater	---	550	510	---	320	270
Total Flow	390	1150	1260	670	1270	1270

(Annual Average Flow is 480 mgd, based on 4 months of high groundwater conditions and 8 months of low groundwater conditions.)

to conservation efforts, increased water and sewer rates, and education could effectively reduce the per capita wastewater production from 65 gpcd to 60 gpcd, which equates to a reduction of 10.5 mgd.

The total average nondomestic flow has been estimated at 103 mgd, which represents approximately 21 percent of the total average annual flow in the year 2020. A ten-percent variation in this flow due to increased industrial or manufacturing activity, or increase in employment in the service area, will not significantly affect the total flow estimate.

The MWRA is developing an I/I policy and program that involves system-wide metering and possibly monitoring. Approximately 150 metering stations covering all 43 communities tributary to the system are planned. This system can be used to track flows and loads as predicted in this report, and can be used to trigger actions to control future flows and loads. Some of the methods available to manage future flows and loads include water and sewer pricing, industrial waste regulations, conservation measures and programs, the use of satellite wastewater treatment facilities, and I/I reduction programs. MWRA is legally committed to not exceed the flow and load projections developed in the Facilities Plan unless all the management methods listed above have been exhausted.

6.4 CONVENTIONAL POLLUTANT LOADS

6.4.1 GENERAL

Secondary treatment plants remove oxygen-demanding substances and suspended matter from the waste stream. These pollutants are measured as five-day biochemical oxygen demand (BOD) and total suspended solids (TSS), respectively. Discharge permits issued to treatment plants by state and federal regulatory agencies specify the maximum concentrations of BOD and TSS that may be discharged by the plant.

The discharge permit recognizes that there is inherent variability in the day-to-day loadings and operation of secondary treatment facilities. Thus, permit limits are specified in terms of concentration and time. MWRA's NPDES permit for secondary treatment has specified that the discharge must contain no more than 30 milligrams per liter (mg/l) BOD or TSS on a monthly average basis, not more than 45 mg/l of either pollutant on a weekly average basis, and not more than 50 mg/l of either pollutant on a daily basis. In order to properly design the wastewater plant to meet these limits, the expected conventional pollutant loading entering the plant has been estimated for the design year 2020.

Estimates of future year average annual pollutant loadings were developed using two steps. First, the current plant loadings were ascertained from historical records and recent sampling data. Second, loading allowances were made for the capture of existing dry weather overflows and CSO management as well as allowances for increased solids contributed to the plant as a result of growth in domestic and nondomestic flows. Additional loadings equaling 10 percent of the influent loads were included as an allowance for sidestreams from sludge processing in the sizing of individual unit processes. This estimate was developed jointly with Black & Veatch

and includes typical loadings from sidestreams encountered at plants with sludge thickening digestion and dewatering facilities. Black & Veatch is planning for separate sidestream treatment facilities for any process, such as wet air oxidation, that produces a sidestream of higher strength than the 10 percent estimate.

6.4.2 TOTAL SUSPENDED SOLIDS LOADS

Existing plant loadings were computed using the combined operating records of the Deer and Nut Island treatment plants for the period from January, 1984 through May, 1986, and the sampling programs conducted as part of this facilities plan. From plant records the average loading on non-rainfall days was calculated to be 444,000 lb/day of TSS. The sampling program, conducted in the fall of 1986 and the spring of 1987 at the four headworks facilities and the two treatment plants, was designed to characterize the wastewater to be treated. The fall 1986 sampling program was conducted in a period of essentially no rain, and observed an average influent TSS load of 445,000 lb/day. Thus the sampling program data showed close agreement with the historic operating data from nonrainfall periods, and therefore, was considered representative of the current average TSS load. During the spring, 1987 sampling period, rainfall was frequent and days with no rainfall could not be interpreted as dry-weather flows because of snowmelt conditions.

Dry weather overflows (DWO) exist in the sewer system tributary to the Authority's treatment plants. A 1979 inspection found 19.4 mgd of DWO in Boston, 0.3 mgd in Chelsea, and 0.2 mgd in Somerville as reported by CH_2 M-Hill. A recent 1986 inspection by Boston Water and Sewer Commission showed that DWO had been reduced to 0.3 to 1.0 mgd in Boston. The inspection could not determine whether DWOs in Chelsea and Somerville had been reduced. Assuming no improvements in these communities, the total DWO for the system would range from 0.3 to 1.5 mgd. Due to the uncertainty of these estimates and because they represent such a small fraction of the total wastewater flow, an allowance of 1.0 mgd is used in this report, although the long-term goal of MWRA is to eliminate all DWOs. The capture of 1 mgd of DWO would result in an additional 1300 lb/day of TSS based on a concentration of 155 mg/l of TSS as measured at the Deer Island Plant.

Increases in both domestic and nondomestic wastewater are expected to occur as a result of increased population and business activity in the service area and as a result of the extension of sewers within the serviced communities. Projections of these two activities indicate an increase of approximately 27 mgd of wastewater flow. At an estimated concentration of 300 mg/l of TSS, an increase in loadings of 67,500 lb/day over current levels is expected from these additional flows. The wastewater concentration of 300 mg/l does not include I/I, which when included, would decrease concentrations to average concentrations found in the Deer Island Plant influent. Therefore, TSS loading is expected to reach approximately 515,000 lb/day during average non-storm days at the design year 2020.

6.4.3 BOD LOADS

Projections for average-day BOD loadings were developed in a manner similar to that used to project TSS loads. Existing plant loadings were computed from the operating records of the

Deer and Nut Island treatment plants for the period from January, 1984 through May, 1986. The total plant average daily loading of BOD on nonrainfall days was 447,000 lb/day. The sampling program conducted in fall of 1986 as part of this facilities plan showed an average daily BOD loading of 500,000 lb/day. Because the fall, 1986 sampling was conducted during a period of very low I/I and essentially no stormwater flows to the plant, and is considered reliable data, the BOD loading for that period was considered representative of current average conditions.

As described earlier, dry weather overflows were shown to exist in the sewer system tributary to the Authority's treatment plants. The allowance of 1 mgd would contain approximately 1,500 lb/day of BOD based on a concentration of 180 mg/l of BOD as measured at the Deer Island Plant.

Increases in both domestic and nondomestic wastewater are expected to occur as a result of increased population and business activity in the service area and as a result of the extension of sewers within the serviced communities. Projections of these two activities indicate an increase of approximately 27 mgd over current wastewater flows. At an estimated concentration of 300 mg/l of BOD, an increase in the BOD load of 67,500 lb/day over the current level is expected at the design year 2020.

BOD loadings are expected to reach 570,000 lb/day during average non-storm periods at the design year 2020.

6.4.4 STORMWATER LOADS

Estimates for conventional pollutant loads from stormwater were developed by analyzing pollutant mass accumulation over the combined sewer service area. The accumulation of pollutants on the land is primarily a function of land use and time between storms. During a major storm event, runoff carries pollutants from the land surface into the combined sewer system. After the storm event, the mass of pollutants begins to accumulate on the land surface again. The accumulation continues until the next storm event when all or some of the pollutant mass is carried by runoff to the combined sewer system.

For TSS, the maximum accumulation over the 12,900-acre combined sewer service area average 40 to 50 lb/acre. This estimate is derived from an average of values ranging from about 75 lb/acre for commercial and industrial land uses, to about 40 lb/acre for residential land, and 10 lb/acre for open space. These are all maximum values developed through calibration of combined sewer models for Boston and other urban areas. The modeling results have also shown that maximum BOD accumulation is generally about 40 percent that of TSS. The total stormwater TSS and BOD loadings conveyed to Deer Island is dependent on the capacity of the interceptor system. For this analysis 60 to 80 percent of the maximum pollutant load was assumed to reach the plant. The calculated total stormwater TSS and BOD loadings are approximately 400,000 lb/day and 165,000 lb/day, respectively.

As noted earlier, the recent preliminary feasibility analysis for deep-tunnel storage for CSO management envisions storage and pumpback of stormflow to the plants. TSS and BOD loadings of 284,000 lb/day and 162,000 lb/day are used in that report.

These estimates are less than the load allowances considered in this report. Thus, for the present, the proposed plant capacity is adequate to treat proposed CSO return flows and loads. The impact of CSOs on the plant will be reevaluated during plant design after definitive estimates are available from the CSO facilities plan.

6.4.5 LOAD VARIABILITY

Table 6.4.5-1 shows the variation in conventional pollutant loadings for the planning period 1990 to 2020. Peaking factors for maximum day, maximum three-day, and maximum month were based on Nut Island plant records of 1975 through 1980 as reported in the Commonwealth of Massachusetts Nut Island Wastewater Treatment Plant Facilities Planning Project, Phase I, Site Options Study as follows:

	Non-Storm Peaking Factors	
	BOD	TSS
Maximum Day	2.0	2.1
Maximum Three Days	1.5	1.6
Maximum Thirty Days	1.3	1.3

These peaking factors are typical of large municipal wastewater treatment facilities and are considered representative of nonstorm conditions in both the North and the South Systems.

Maximum day with storm includes allowances for stormwater loads to the plant. During the sampling program and in previous studies no correlation between plant flow and load has been observed. Approximately equal amounts of loading have been carried to the plant with flows ranging from low flow to two to three times low flow. Therefore the pollutant loading from stormwater may be carried with an average flow of a few hundred mgd or with a flow of 960 mgd. For the purpose of quantifying loadings to the plant, the maximum quantity of stormwater BOD (165,000 lb/day) and TSS (400,000 lb/day) load is shown for each storm event.

6.4.6 WASTEWATER CHARACTERIZATION

The results of the fall, 1986 and spring, 1987 sampling programs were used to determine the general character of MWRA wastewaters. Characterization parameters for Deer Island, Nut Island, and combined Deer Island and Nut Island flows are presented in Table 6.4.6-1. Parameters for typical domestic wastewaters are also presented.

The Deer Island and Nut Island wastewaters are essentially identical in organic characteristics and both are largely domestic in nature. The wastewaters are biodegradable and sufficient nutrients are present for biological treatment.

TABLE 6.4.5-1

SUMMARY OF CONVENTIONAL POLLUTANT LOADINGS
(1000 lb/day)

	1990	2000	2010	2020
BOD (1000 lb/day)				
Average Day	505	537	554	570
Maximum Day	1010	1074	1108	1140
Maximum Day with Storm	1175	1239	1273	1305
Maximum Three Days	758	806	831	855
Maximum Month	657	698	720	741
TSS (1000 lb/day)				
Average Day	450	481	498	515
Maximum Day	945	1010	1046	1080
Maximum Day with Storm	1345	1410	1446	1480
Maximum Three Days	720	770	797	824
Maximum Month	585	625	647	670

TABLE 6.4.6-1

RAW WASTEWATER CHARACTERIZATION[1]

	Deer Island	Nut Island	Combined Flows	Typical Domestic Wastewater
BOD/COD	0.67	0.73	0.69	0.40 - 0.70
BOD/TSS	1.2	0.95	1.1	1.0
TVSS/TSS	0.77	0.76	0.77	0.68 - 0.80
BOD/TKN	7.6	8.4	7.8	4.0 - 7.0
BOD/P	44	39	45	20
BOD RATE COEFFICIENT - BASE 10	0.11	0.12	---	0.10 - 0.13
BOD_5 / BOD_u	0.72	0.72	---	0.70 - 0.80

(1) Based on fall 1986 and spring 1987 Sampling Program

BOD - BOD_5 = Biochemical Oxygen Demand
COD = Chemical Oxygen Demand
TSS = Total Suspended Solids
TVSS = Total Volatile Suspended Solids
TKN = Total Kjeldahl Nitrogen
P = Phosphorus
BOD_u = Ultimate Biochemical Oxygen Demand

6.5 NON-CONVENTIONAL POLLUTANT LOADINGS

6.5.1 GENERAL

Non-conventional pollutants are those constituents which can be harmful when found in excessive concentrations. They can be categorized as being toxic, carcinogenic, flammable, corrosive, or hazardous. They include heavy metals, volatile organics, pesticides, and PCBs. These non-conventional pollutants are classified under the EPA's Priority Pollutant List (PPL) and the Hazardous Substances List (HSL). The PPL and the HSL cover metals as well as organics. The HSL parameters nearly duplicate those found in the PPL. The chemical categories within these classifications include metals, acids and base neutral organics, volatile organics, pesticides, and PCBs.

Non-conventional pollutants have been evaluated in this study because of their potential adverse impact when released into the environment as part of plant effluent, sludges, or air emissions.

Secondary treatment removes some, but not all, non-conventional pollutants from the wastewater. Therefore, a fraction of the non-conventional pollutants pass through the system and into the receiving water. The EPA has developed a series of water quality criteria known as the "Gold Book Criteria" which specify the acceptable levels of these constituents in receiving waters. The results of the following waste characterization studies will be used, along with studies of removal efficiencies and circulation, in the outfall siting studies to assess the potential impacts of MWRA on compliance with the water quality criteria.

Some pollutants that are removed during the treatment processes become part of the residuals from the plant. Residuals management options can be limited by the concentration of non-conventional pollutants. Both EPA and DEQE have regulations limiting the amounts of certain non-conventional pollutants allowed in conjunction with different residuals management options. These issues will be explored as part of the Residuals Management Facilities Plan.

The emission of volatile organics to the air during treatment must also be considered. EPA and DEQE have regulations to guide the evaluations of the emission of contaminants to the air. This topic is discussed in the Air Emissions Control section of Volume III.

In order to characterize the parameters described by these three sets of guidelines, sampling and analysis of the waste was conducted in the fall of 1986 and spring of 1987, including analyses of chemicals in the PPL and HSL directories. It should be noted that the study undertaken herein is a broad characterization of these pollutants and future detailed studies related to each specific guideline, e.g., Gold Book Criteria, will be conducted as required as part of the outfall siting or Residuals Management Facilities Plan.

In this report, non-conventional pollutants are reported in the same categories as defined in

the PPL and HSL directives, namely, metals including cyanide, acid and base neutral (ABN) organics, pesticides and PCBs, and volatile organic compounds (VOCs).

Summary of Sampling Program

A wastewater sampling program was conducted during two seasons: fall of 1986 and spring of 1987. During 1986, samples were collected primarily at the headworks to Deer Island, with some samples collected at Deer Island and at the Nut Island influent. During 1987, samples were collected at only the Deer Island and Nut Island influents. (For more information regarding the sampling program, refer to Appendix B of Volume III.) A summary of the results of the sampling program describing the number of samples and frequency of detection for metals, ABNs, pesticides, PCBs, and VOCs is shown in Tables 6.5.1-1 through 6.5.1-4, respectively. It should be noted that the large number of samples in the fall program reflects the fact that the sampling was performed at each of four headworks rather than at the plant influents only.

The sampling program included collection at the headworks for Deer Island, at the Deer Island and Nut Island Influents, at the Nut Island and Deer Island effluents, and some limited sludge sampling at Deer Island and Nut Island. However, for the purposes of characterizing current waste loads and predicting future waste loads, only the influent values were considered.

To characterize the metals loads to the proposed treatment plant, influent samples were collected for six days in the fall and for nine days in the spring. For ABNs, samples were collected for 6 days in the fall and for three days in the spring. Pesticide and PCB samples were collected on five days in the fall and on three days in the spring, while for VOCs, eight fall samples and three spring samples were collected.

The following sections discuss the actual results of the sampling programs and the predicted future loads.

Prediction Of Future Loads

In this document, the future wasteloads of non-conventional pollutants are estimated to be the same as the current wasteloads. In actuality, as a result of MWRA's industrial waste pretreatment program, future wasteloads are expected to be lower than current loads. MWRA is reexamining the program and has recently decided to add additional resources during the next three years. However, since the results of the pretreatment program cannot be predicted adequately at this time, the current loads are used here as a conservative estimate of future loads. It should be noted that increased future flows have been reflected in these estimates. An analysis will be performed as part of the Residuals Management Facilities Plan to determine the impact of lower sludge metals concentrations on sludge management options resulting from the pretreatment program.

6.5.2 METALS

The purpose of this section is to set forth conclusions regarding the characterization of metal loadings for the Nut Island and Deer Island treatment plants.

TABLE 6.5.1-1

SUMMARY OF SAMPLING PROGRAM RESULTS
TOTAL METALS

	Fall Program				Spring Program			
		Frequency of Detection		Detection Limit (μg/l)		Frequency of Detection		Detection Limit (μg/l)
Constituent	Number of Samples	Number	Percent	(1)	Number of Samples	Number	Percent	(1)
ANTIMONY	40	0	0	25	16	3	19	2
ARSENIC	40	0	0	10	19	13	68	1
BERYLLIUM	40	0	0	20	16	0	0	1
BORON	40	5	135	200	16	16	100	50
CADMIUM	40	1	3	5	19	12	63	1
CHROMIUM	40	40	100	5	19	19	100	1
COPPER	40	38	95	50	19	19	100	1
CYANIDE, TOTAL	36	2	6	20 or 40	16	2	13	10
LEAD	40	36	90	5	19	15	79	5

NOTE:

(1) Detection limits were lowered for the Spring sampling program to reflect comparisons to EPA Water Quality Criteria.

TABLE 6.5.1-1

SUMMARY OF SAMPLING PROGRAM RESULTS
TOTAL METALS
(Continued)

	Fall Program				Spring Program			
		Frequency of Detection				Frequency of Detection		
Constituent	Number of Samples	Number	Percent	Detection Limit (µg/l) (1)	Number of Samples	Number	Percent	Detection Limit (µg/l) (1)
MERCURY	40	8	20	1	16	12	75	0.5
MOLYBDENUM	40	0	0	50 or 100	16	14	88	1
NICKEL	40	16	40	20	19	19	100	2
SELENIUM	40	2	5	10	16	0	0	4
SILVER	40	9	23	5	19	16	84	2
THALLIUM	40	0	0	10	16	0	0	2
ZINC	40	40	100	2	19	19	100	4

NOT DETECTED -- METALS

BERYLLIUM
THALLIUM
HEXAVALENT CHROMIUM

NOTE:

(1) Detection limits were lowered for the spring sampling program to reflect comparisons to EPA Water Quality Criteria.

TABLE 6.5.1-2

SUMMARY OF SAMPLING PROGRAM RESULTS
TOTAL ACID AND BASE NEUTRALS

	Fall Program				Spring Program			
		Frequency of Detection				Frequency of Detection		
Constituent	Number of Samples	Number	Percent	Detection Limit Range (μg/l)	Number of Samples	Number	Percent	Detection Limit Range (μg/l)
Phenol	21	15	71	20 - 28	6	1	17	20 - 27
Benzyl Alcohol	21	13	62	20 - 28	6	0	0	20 - 27
1,2-Dichlorobenzene	21	3	14	20 - 28	6	0	0	20 - 27
2-Methylphenol	21	2	10	20 - 28	6	0	0	20 - 27
4-Methylphenol	21	17	81	20 - 28	6	3	50	20 - 27
Benzoic Acid	21	16	76	100 - 140	6	1	17	100 - 130
Naphthalene	21	14	67	20 - 28	6	1	17	20 - 27
2-Methylnaphthalene	21	16	76	20 - 28	6	1	17	20 - 27
2,4,5-Trichlorophenol	21	1	5	100 - 140	6	0	0	100 - 130
Dimethyl Phthalate	21	1	5	20 - 28	6	1	17	20 - 27
Diethyl Phthalate	21	3	14	20 - 28	6	1	17	20 - 27
N-Nitrosodiphenylamine (1)	21	1	5	20 - 28	6	0	0	20 - 27

TABLE 6.5.1-2

SUMMARY OF SAMPLING PROGRAM RESULTS
TOTAL ACID AND BASE NEUTRALS
(Continued)

	Fall Program				Spring Program			
		Frequency of Detection				Frequency of Detection		
Constituent	Number of Samples	Number	Percent	Detection Limit Range (µg/l)	Number of Samples	Number	Percent	Detection Limit Range (µg/l)
Di-n-butyl Phthalate	21	4	19	20 - 28	6	1	17	20 - 27
Butylbenzyl Phthalate	21	5	24	20 - 28	6	2	33	20 - 27
Bis(2-ethylhexyl)Phthalate	21	20	95	20 - 28	6	6	100	20 - 27
				20 - 28				
Di-n-octyl Phthalate	21	3	14	20 - 28	6	2	33	20 - 27

NOT DETECTED -- Acid and Base Neutrals

Bis (2-Chloroethyl)ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4 Dichlorobenzene
Bis(2-Chloroisopropyl)ether
Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Acenaphthylene
Hexachlorobenzene
Pentachlorophenol
Phenanthrene
Anthracene
Fluoranthene

TABLE 6.5.1-3

SUMMARY OF SAMPLING PROGRAM RESULTS
TOTAL PESTICIDES AND PCB

	Fall Program				Spring Program			
		Frequency of Detection				Frequency of Detection		
Constituent	Number of Samples	Number	Percent	Detection Limit (μg/l)	Number of Samples	Number	Percent	Detection Limit Range (μg/l)
ALPHA-BHC	17	0	0	0.05	6	0	0	0.50-1
BETA-BHC	17	0	0	0.05	6	0	0	0.05-1
DELTA-BHC	17	0	0	0.05	6	0	0	0.05-1
GAMMA-BHC	17	0	0	0.05	6	0	0	0.05-1
HEPTACHLOR	17	0	0	0.05	6	0	0	0.05-1
ALDRIN	17	0	0	0.05	6	0	0	0.05-1
HEPTACHLOR EPOXIDE	17	0	0	0.05	6	0	0	0.05-1
ENDOSULFAN I	17	0	0	0.05	6	0	0	0.05-1
DIELDRIN	17	0	0	0.10	6	0	0	0.10-2
4,4' -DDE	17	0	0	0.10	6	0	0	0.10-2
ENDRIN	17	0	0	0.10	6	0	0	0.10-2
ENDOSULFAN II	17	0	0	0.10	6	0	0	0.10-2

Note: All the Pesticides and PCBs that were tested for are listed above. None were detected.

TABLE 6.5.1-3

SUMMARY OF SAMPLING PROGRAM RESULTS
TOTAL PESTICIDES AND PCBS
(Continued)

	Fall Program				Spring Program			
		Frequency of Detection				Frequency of Detection		
Constituent	Number of Samples	Number	Percent	Detection Limit (µg/l)	Number of Samples	Number	Percent	Detection Limit Range (µg/l)
4,4' -DDD	17	0	0	0.10	6	0	0	0.10-2.0
ENDOSULFAN SULFATE	17	0	0	0.10	6	0	0	0.10-2.0
4,4' - DDT	17	0	0	0.10	6	0	0	0.10-2.0
ENDRIN KETONE	17	0	0	0.10	6	0	0	0.10-2.0
METHOXYCHLOR	17	0	0	0.50	6	0	0	0.50-10
CHLORDANE (TECHNICAL)	17	0	0	0.50	6	0	0	0.50-10
TOXAPHENE	17	0	0	1.00	6	0	0	1-2.0
AROCLOR-1016	17	0	0	0.50	6	0	0	0.50-10
AROCLOR-1221	17	0	0	0.50	6	0	0	0.50-10
AROCLOR-1232	17	0	0	0.50	6	0	0	0.50-10
AROCLOR-1242	17	0	0	0.50	6	0	0	0.50-10
AROCLOR-1248	17	0	0	0.50	6	0	0	0.50-10
AROCLOR-1254	17	0	0	1.00	6	0	0	1-20
AROCLOR-1260	17	0	0	1.00	6	0	0	1-20

Note: All the Pesticides and PCBs that were tested for are listed above. None were detected.

TABLE 6.5.1-4

SUMMARY OF SAMPLING PROGRAM RESULTS
TOTAL VOLATILE ORGANIC COMPOUNDS

	Fall Program				Spring Program			
		Frequency of Detection				Frequency of Detection		
Constituent	Number of Samples	Number	Percent	Detection Limit Range (µg/l)	Number of Samples	Number	Percent	Detection Limit (µg/l)
Bromomethane	108	0	0	10 - 25	16	12	75	10
Methylene Chloride	108	44	41	12 - 12	16	16	100	5
Acetone	108	39	36	25 - 25	16	16	100	5
Carbon Disulfide	108	2	2	5 - 12	16	9	56	5
trans-1,2-Dichloroethene	108	19	18	5 - 12	16	13	81	5
Chloroform	108	23	21	5	16	16	100	5
2-Butanone	108	4	4	10 - 25	16	14	88	5
1,1,1-Trichloroethane	108	26	24	5 - 12	16	16	100	5
Trichloroethene	108	24	22	5 - 12	16	16	100	5
Benzene	108	16	15	5	16	16	100	5
4-Methyl-2-Pentanone	108	2	2	10 - 25	16	0	0	10
Tetrachloroethene	108	36	33	5 - 12	16	16	100	5

TABLE 6.5.1-4

SUMMARY OF SAMPLING PROGRAM RESULTS
TOTAL VOLATILE ORGANIC COMPOUNDS
(Continued)

Constituent	Fall Program				Spring Program			
	Number of Samples	Frequency of Detection		Detection Limit Range (µg/l)	Number of Samples	Frequency of Detection		Detection Limit (µg/l)
		Number	Percent			Number	Percent	
1,1,2,2-Tetrachloroethane	108	4	4	5 - 12	16	0	0	5
Toluene	108	76	70	5	16	16	100	5
Chlorobenzene	108	0	0	5 - 12	16	3	19	5
Ethylbenzene	108	18	17	5 - 12	16	14	88	5
Styrene	108	3	3	5 - 12	16	6	38	5
Total Xylene; M.O. and P	108	50	46	5 - 12	16	16	100	5

Not Detected VOLATILE COMPOUNDS

Chloromethane
Vinyl Chloride
Chloroethane
1,1-Dichloroethene
1,1-Dichloroethane
1,2-Dichloroethane
Carbon Tetrachloride
Vinyl Acetate
Bromodichloromethane
1,2-Dichloropropane
trans-1,3-Dichloropropene
Dibromochloromethane
1,1,2-Trichloroethane
cis-1,3-Dichloropropene
2-Chloroethylvinylether
Bromoform
2-Hexanone

This section discusses the results of recent sampling programs for metals, the increase in metal loadings that are expected to result from increased wastewater flows, and the potential impact of increased capture of stormwater runoff through a combined sewer overflow control program.

The estimated average mass loading and associated standard deviations are shown in Table 6.5.2-1 for constituents that were detected at least once during either testing program. The average mass is the sum of the average of the total pounds of pollutant found at Nut Island and Deer Island. The total pounds of pollutant for each day is based on the concentration measured in each sample and flow readings that were recorded on the day of the sample. In a number of cases, the concentrations were reported from the laboratory as below the detection limit (BDL) of the test method. In these instances, the following procedure was followed:

- For spring samples (which generally had the lowest detection limits), the detection limit was used as the concentration.

- Fall detection limits for metals were too high in several cases because all samples reported the concentration to be "Below Detection Limit." For this reason detection limits were lowered in the spring. The spring detection limits were low enough to indicate metal concentrations in most cases. Thus, the fall detection limit was used if the spring sampling indicated that the loading was at or above the fall detection limit. If the spring sampling indicated that the concentration would have been below both the fall and the spring detection limits, the sample was not used in the analysis.

For three metals, beryllium, thallium, and hexavalent chromium (spring samples only), concentrations were always below the detection limit. In these cases no average loading is presented.

Metal Loads in the Future

For the purpose of estimating future mass loading that results from increases in wastewater flows, the metal loads have been increased in the same ratio as the increase in wastewater flows. If it is assumed that wastewater (as distinguished from infiltration/inflow) will increase from an average annual flow of 208 mgd to 239 mgd in the future, then the total metal loading would increase by the same percentage (15 percent) over the same period of time. This approach assumes that future wastewater characteristics will be very similar to current characteristics.

The only significant change in system operation that will affect metal loadings is the increased capture of CSOs. As new stormwater retention facilities are completed, CSOs will be reduced. This will increase the plant loadings for metals. Quantifying the increase in loadings that will result from CSO capture is a complex problem.

TABLE 6.5.2-1

EXISTING METAL LOADINGS

Constituent	Average Load (lbs/day)	Standard Deviation (lbs/day)
Antimony	10.8	2.3
Arsenic	6.0	1.9
Boron	1260	2440
Cadmium	7.1	2.7
Chromium	75.8	29.5
Copper	345	103
Cyanide, Total	53.9	13.9
Lead	49.9	21.8
Mercury	4.1	5.2
Molybdenum	17.1	10.4
Nickel	66.0	29.5
Selenium	35.2	33.2
Silver	15.5	3.8
Zinc	739	842

Note: Average Load represents the non-storm mean load at Deer Island plus the non-storm load at Nut Island. Loadings are based on influent values only, which are reported in Summary Memorandum FB20C, and are the result of sample collections at the headworks for Deer Island, and Deer and Nut Island Influents.

Estimates of metal loadings from the fall sampling program are considered dry weather loads because sampling occurred during periods of dry weather. For this reason these loadings include all pollutants from domestic, commercial, and industrial activities. Therefore, the increased loads resulting from CSO capture equals the loadings from stormwater runoff.

To estimate the quality of stormwater, runoff information from EPA's Nationwide Urban Runoff Program (NURP) was used. Stormwater runoff metals quality from the NURP is summarized in Table 6.5.2-2. The values selected as estimates of urban stormwater quality in the MWRA service area were not subject to any special statistical analyses, but were selected as being representative of the range of observed CSO values.

Mass loadings of pollutant metals resulting from CSO capture are based on the selected values presented in Table 6.5.2-2. The average annual return of stormwater runoff from CSO capture is estimated to be 20 mgd. The tributary area is approximately 12,900 acres. About 50 percent of the area is impervious, and the calculated total annual runoff is 7.3 billion gallons. Where no NURP value was chosen for a pollutant, the estimated loadings were based on the percentage of increased CSO capture to existing flow (20/208 = 15 percent).

Summary of Future Metal Loads

Aggregate future metal loads were computed based on an existing load, and increases from new wastewater and capture of urban runoff. The results of these computations are shown in Table 6.5.2-3. These are annual average loadings, and are subject to day-to-day variability.

6.5.3 ACID BASE NEUTRALS

This section describes the characterization of acid and base-neutral (ABN) loadings for the Nut Island and Deer Island Treatment Plants. The ABN terminology arises from the analytical methods used to quantify these organic compounds. The methods use either an acid or base-neutral extraction in the procedure. In the aggregate, there are 66 organic chemicals classified under the PPL and HSL, which comprise the ABN fractions.

Fall and Spring Sampling Program Results

Estimates of the existing average mass and standard deviations of the detected ABN compounds are shown in Table 6.5.3-1. As was done with the metals fractions, the average mass is based on the observed flows on the day of sampling, as well as the observed concentrations, while test results that were below the analytical detection limit were replaced with the detection limit.

ABN Loads in the Future

Increases in future loadings of the ABN fraction were also computed in a manner comparable to that used for metals. Increases in future loadings attributable to increases in wastewater

TABLE 6.5.2-2

RUNOFF QUALITY - METALS

Constituent	Frequency of Detection Percent (1)	Range of Observed Values (1) (μg/l)	Estimated Range of Mean Values (1) (μg/l)	Selected Value (2) (μg/l)
Antimony	13	2.6-23		23.0
Arsenic	52	1-50	1.6-4.3	4.3
Boron	Not Done			NA
Cadmium	48	1-14	.6-1.6	1.6
Chromium	58	1-190	3.1-8.5	8.5
Copper	91	1-100	17.9-19.5	19.5
Cyanide, Total	23	2-300		300.0
Lead	94	6-460	65.6-72.8	72.8
Mercury	9	0.6-1.2		1.2
Molybdenum	Not Done			NA
Nickel	43	1-182	5.8-19.1	19.1
Selenium	11	2-77		77.0
Silver	7	0.2-0.8		0.8
Zinc	94	10-2400	92.3-104	104

Notes: (1) The data are taken from the EPA's National Urban Runoff Program study.

(2) The selected value is the upper confidence interval of the geometric mean of pollutants detected more than 20 percent of the time, or the maximum observed value, where an estimated mean value does not exist.

TABLE 6.5.2-3

FUTURE METAL LOADINGS

Constituent	Existing Average Mass Loadings (lb/day)	Flow-Related Increase (1) (lb/day)	Projected Non-Runoff Average Mass Loadings (2) (lb/day)	Runoff Loadings Increase (3) (lb/day)	Projected Total Average Mass Loadings (4) (lb/day)
Antimony	10.8	1.6	12.4	3.8	16.2
Arsenic	6.0	0.9	6.9	0.7	7.6
Boron	1260	188	1450	121	1570
Cadmium	7.1	1.1	8.2	0.3	8.4
Chromium	75.8	11.3	87.1	1.4	88.5
Copper	345	51.4	397	3.3	400
Cyanide, Total	53.9	8.0	61.9	50.0	112
Lead	49.9	7.4	57.3	12.1	69.5
Mercury	4.1	0.6	4.8	0.2	5.0
Molybdenum	17.1	2.6	19.7	1.6	21.3
Nickel	66.0	9.8	75.9	3.2	79.1
Selenium	35.2	5.2	40.4	12.8	53.3
Silver	15.5	2.3	17.8	0.1	18.0
Zinc	739	110.1	849	17.3	866

Notes: (1) Wastewater incremented in proportion to increases in wastewater discharges. Average daily flow is projected to increase from 208 mgd to 239 mgd.

(2) The projected Non-Runoff Average Mass Loading is the sum of the Existing Average Mass Loading and the Flow-Related Increase.

(3) The Increase from the Runoff Loading is based on either:

(a) the average daily runoff return flow equal to 20 mgd and concentrations taken from the "Selected" column of Table 8.4.2-2, or

(b) the average daily runoff return flow equal to 20 mgd and concentrations taken from the existing average mass loading with flow equal to 208 mgd.

(4) The Projected Total Average Mass Loading is the sum of the Projected Non-Runoff Average Mass Loadings and the Runoff Loadings Increase.

TABLE 6.5.3-1

EXISTING ABN LOADINGS

Constituent	Average Load (lb/day)	Standard Deviation (lb/day)
Phenol	54.0	27.1
Benzyl Alcohol	69.3	24.7
1,2-Dichlorobenzene	65.1	23.3
2-Methylphenol	71.0	18.3
4-Methylphenol	61.2	23.2
Benzoic Acid	269	139
Naphthalene	45.3	28.4
2-Methylnaphthalene	49.6	26.7
2,4,5-Trichlorophenol	349	95.8
Dimethyl Phthalate	69.6	19.4
Diethyl Phthalate	57.1	24.5
N-Nitrosodiphenylamine (1)	69.3	19.7
Di-n-butyl Phthalate	57.9	25.9
Butylbenzyl Phthalate	54.0	24.1
Bis (2-ethylhexyl) Phthalate	67.8	20.0
Di-n-octyl Phthalate	57.0	21.4

Note: Average Load represents the non-storm mean load at Deer Island plus the non-storm mean load at Nut Island. Loadings are based on influent values only, which are reported in Summary Memorandum FB20C, and are the result of sample collections at the headworks for Deer Island and Deer and Nut Island Influents.

flow (as distinguished from infiltration and inflow) were taken as the pro rata increase in flow.

Increases in loadings of ABNs associated with improved CSO management practices have been estimated based on the estimated average runoff volume of 20 mgd and concentrations of ABNs in urban runoff. Data from EPA's NURP Program were used to select a value for runoff quality for those compounds that were detected in the wastewater sampling. Information concerning the compounds, their frequencies of detection and ranges of concentrations are presented in Table 6.5.3-2.

For the purpose of estimating runoff loads, the highest observed values were used. If the constituent was not analyzed as part of the NURP program, the existing load was incremented by the ratio of the projected runoff flow to the wastewater flow.

Summary of Future ABN Loads

Aggregate future ABN loadings were computed based on the existing loads, increases from new wastewater generated in the service area, and capture of urban runoff. The results of these computations are shown in Table 6.5.3.-3. These are subject to day-to-day variability.

6.5.4 PESTICIDES AND PCBs

Fall and Spring Sampling Program Results

Since no pesticides or PCBs were found in this sampling, specific projects may have to be implemented to investigate these compounds further.

These should include an evaluation of sludge in conjunction with wastewater sampling. Interpolation of PCBs and pesticides in the sludge to a projected influent can be made. However, at this time sufficient data is not available to calculate these values.

6.5.5 VOLATILE ORGANIC COMPOUNDS

Unlike the other constituents, where composite samples were always taken from the influent to the Nut and Deer Island plants, the volatile sampling differed in the following respects:

- The analytical protocols require that grab samples be used. In this program, grab samples were taken every six hours.

- During the fall program, samples of the Deer Island influent were not taken. Rather, samples were taken at each of the four headworks. The results of these were combined to produce an estimate of the Deer Island load.

TABLE 6.5.3-2

RUNOFF QUALITY - ABNS

Constituent	Frequency of Detection Percent	Range of Values (μg/l)	Selected Value (μg/l)
Phenol	14	1-13	13.0
Benzyl Alcohol	Not Done	NA	NA
1,2-Dichlorobenzene	0	0	0.0
2-Methylphenol	Not Done	NA	NA
4-Methylphenol	Not Done	NA	NA
Benzoic Acid	Not Done	NA	NA
Naphthalene	9	0.8-2.3	2.3
2-Methylnaphthalene	Not Done	NA	NA
2,4,5-Trichlorophenol	Not Detected	0	0.0
Dimethyl Phthalate	1	1	1.0
Diethyl Phthalate	6	1-10	10.0
N-Nitrosodiphenylamine (1)	Not Done	NA	NA
Di-n-butyl Phthalate	6	0.5-11	11.0
Butylbenzyl Phthalate	6	1-10	10.0
Bis (2-ethylhexyl) Phthalate	22	0.4-2	2.0
Di-n-octyl Phthalate	6	0.5-2	2.0

TABLE 6.5.3-3

FUTURE ABN LOADINGS

Constituent	Existing Average Mass Loadings (lb/day)	Flow Related-Increase (1) (lb/day)	Projected Non-Runoff Average Mass Loadings (2) (lb/day)	Runoff Loadings Increase (3) (lb/day)	Projected Total Average Mass Loadings (4) (lb/day)
Phenol	54.0	8.0	62.1	2.2	64.2
Benzyl Alcohol	69.3	10.3	79.7	6.7	86.3
1,2-Dichlorobenzene	65.1	9.7	74.8	0.0	74.8
2-Methylphenol	71.0	10.6	81.5	6.8	88.4
4-Methylphenol	61.2	9.1	70.4	5.9	76.3
Benzoic Acid	269	40.2	310	25.9	336
Naphthalene	45.3	6.8	52.1	0.4	52.5
2-Methylnaphthalene	49.6	7.4	57.0	4.8	61.8
2,4,5-Trichlorophenol	349	52.0	401	0.0	401
Dimethyl Phthalate	69.6	10.4	80.0	0.2	80.2
Diethyl Phthalate	57.1	8.5	65.6	1.7	67.3
N-Nitrosodiphenylamine (1)	69.3	10.3	79.6	6.7	86.3
Di-n-butyl Phthalate	57.9	8.6	66.5	1.8	68.4
Butylbenzyl Phthalate	54.0	8.0	62.0	1.7	63.7
Bis (2-ethylhexyl) Phthalate	67.8	10.1	77.9	0.3	78.3
Di-n-octyl Phthalate	57.0	8.5	65.5	0.3	65.8

Notes: (1) Wastewater incremented in proportion to increases in wastewater discharges. Average daily flow is projected to increase from 208 mgd to 239 mgd.

(2) The Projected Non-Runoff Average Mass Loading is the sum of the Existing Average Mass Loading and the Flow-Related Increase.

(3) Storm flow loads are based on either:

(a) the average daily runoff return flow equal to 20 mgd and concentrations taken from the "Selected" column of Table 8.4.3-2. or

(b) the average daily runoff return flow equal to 20 mgd and concentrations taken from the existing average mass loading with flow equal to 208 mgd.

(4) The Projected Total Average Mass Loading is the sum of the Projected Non-Runoff Average Mass Loadings and the Runoff Loadings Increase.

Fall and Spring Sampling Program Results

Estimates of the existing average mass and standard deviations of the detected volatile compounds are shown in Table 6.5.5-1. As was done with the metals fractions, the average mass is based on the observed flows and observed concentrations at the time of sampling, while test results which were below the analytical detection limit were replaced with the detection limit.

Volatile Organics Loads in the Future

Increases in future loadings of the volatile fraction were also computed in a manner comparable to that used for metals and ABNs. Increases in loadings of volatiles associated with improved CSO management practices have been estimated based on the estimated average runoff volume of 20 mgd and the concentrations of volatiles in urban runoff. Data from EPA's NURP Program were used to select a value for runoff quality for those compounds which were detected in the wastewater sampling. Information concerning the compounds, their frequencies of detection, and ranges of concentrations are presented in Table 6.5.5-2. For the purpose of estimating runoff loads, the highest observed values were used. If the constituent was not analyzed as part of the NURP program, the existing load was incremented by the ratio of the projected runoff flow to the wastewater flow.

Summary of Future Volatile Loads

Aggregate future volatile loadings were computed based on the existing loads, increases from new wastewater generated in the service area, and capture of urban runoff. The results of these computations are shown in Table 6.5.5-3. These are subject to day-to-day variability.

6.6 SUMMARY

This section on flows and loads has reached the following conclusions:

- The connected population of the Authority's sewer service area will increase from the present estimate of approximately 1.9 million to 2.1 million in the design year 2020. This will result in an increase of about 13 mgd of domestic wastewater flow over the current level of 123 mgd.

- Through the year 2020, wastewater discharges that result from the business activity within the service area will increase by approximately 14 mgd, from 46 mgd at present to 60 mgd in the year 2020. The increase is due entirely to increases in wastewater flows from service-oriented business. The total volume of wastewaters discharged by large users is expected to remain relatively constant at 43 mgd over the period. Total nondomestic wastewater discharges are expected to average 103 mgd in the design year.

TABLE 6.5.5-1

EXISTING VOLATILE LOADINGS

Constituent	Average Load (lb/day)	Standard Deviation (lb/day)
Bromomethane	54.3	19.3
Methylene Chloride	104.7	75.3
Acetone	337.1	268.6
Carbon Disulfide	27.5	7.6
trans-1,2-Dichloroethene	25.6	7.8
Chloroform	17.6	8.1
2-Butanone	82.5	43.8
1,1,1-Trichloroethane	41.8	17.9
Trichloroethene	36.2	19.2
Benzene	12.5	2.3
4-Methyl-2-Pentanone	64.7	23.7
Tetrachloroethene	47.4	27.8
1,1,2,2-Tetrachloroethane	29.4	6.4
Toluene	60.8	38.1
Chlorobenzene	28.0	7.6
Ethylbenzene	28.8	13.0
Styrene	30.1	7.3
Total Xylene; m-, o-, and p-	85.9	59.4

Note: Average Load represents the non-storm mean load at Deer Island plus the non-storm mean load at Nut Island. Loadings are based on influent values only, which are reported in Summary Memorandum FB20C, and are the result of sample collections at the headworks for Deer Island and Deer and Nut Island Influents.

TABLE 6.5.5-2

RUNOFF QUALITY - VOLATILES

Constituent	Frequency of Detection Percent	Range of Values (μg/L)	Selected Value (μg/L)
Bromomethane	Not Detected	0	0.0
Methylene Chloride	Not Detected	0	0.0
Acetone	Not Done	NA	NA
Carbon Disulfide	Not Done	NA	NA
trans-1,2-Dichloroethene	4	1-3	3.0
Chloroform	9	0.2-12	12.0
2-Butanone	Not Done	NA	NA
1,1,1-Trichloroethane	6	1.6-10	10.0
Trichloroethene	6	0.3-12	12.0
Benzene	5	1-13	13.0
4-Methyl-2-Pentanone	Not Done	NA	NA
Tetrachloroethene	5	1-43	43.0
1,1,2,2-Tetrachloroethane	4	2-3	3.0
Toluene	3	3-9	9.0
Chlorobenzene	5	1-10	10.0
Ethylblenzene	6	1-2	2.0
Styrene	Not Done	NA	NA
Total Xylene; m-, o-, and p-	Note Done	NA	NA

TABLE 6.5.5-3

FUTURE VOLATILE LOADINGS

Constituent	Existing Average Mass Loadings (lb/day)	Flow-Related Increase (1) (lb/day)	Projected Non-Runoff Average Mass Loadings (2) (lb/day)	Runoff Loadings Increase (3) (lb/day)	Projected Total Average Mass Loadings (4) (lb/day)
Bromomethane	54.3	8.1	62.3	0.0	62.3
Methylene Chloride	105	15.6	120	0.0	120
Acetone	337	50.2	387	32.4	420
Carbon Disulfide	27.5	4.1	31.6	2.6	34.3
trans-1,2-Dichloroethene	25.6	3.8	29.4	0.5	29.9
Chloroform	17.6	2.6	20.3	2.0	22.3
2-Butanone	82.5	12.3	94.8	7.9	103
1,1,1-Trichloroethane	41.8	6.2	48.0	1.7	49.7
Trichloroethene	36.2	5.4	41.6	2.0	43.6
Benzene	12.5	1.9	14.3	2.2	16.5
4-Methyl-2-Pentanone	64.7	9.6	74.3	6.2	80.5
Tetrachloroethene	47.4	7.1	54.5	7.2	61.7
1,1,2,2-Tetrachloroethane	29.4	4.4	33.8	0.5	34.3
Toluene	60.8	9.1	69.8	1.5	71.3
Chlorobenzene	28.0	4.2	32.1	1.7	33.8
Ethylbenzene	28.8	4.3	33.1	0.3	33.4
Styrene	30.1	4.5	34.6	2.9	37.5
Total Xylene; m-, o-, and p	85.9	12.8	98.7	8.3	107

Notes: (1) Wastewater incremented in proportion to increases in wastewater discharges. Average daily flow is projected to increase from 208 mgd to 239 mgd.

(2) The Projected Non-Runoff Average Mass Loading is the sum of the Existing Average Mass Loading and the Flow-Related Increase.

(3) Storm flow loads are based on either:

(a) the average daily runoff return flow equal to 20 mgd and concentrations taken from the "Selected" column of Table 8.4.5-2, or

(b) average daily runoff return flow equal to 20 mgd and concentrations taken from the existing average mass loading with flow equal to 208 mgd.

(4) The Projected Total Average Mass Loading is the sum of the Projected Non-Runoff Average Mass Loadings and the Runoff Loadings Increase.

- Total domestic and nondomestic wastewater flows will average about 239 mgd by the year 2020.

- Rainfall-induced flows, both infiltration/inflow (I/I) and combined sewage flows, will continue to represent a large fraction of the volume of wastewater received at the plant. Average I/I is expected to vary from approximately 150 mgd to 430 mgd, depending on time of the year and groundwater levels. While significant, the I/I allowances are based on substantial reductions from existing maximum I/I amounts and require the implementation of various correction programs now being studied by the Authority and the Commonwealth.

- The total flow to be accommodated from MWRA's South System service area is 360 mgd. This flow is the hydraulic capacity, without surcharging, of the South System's major interceptor, the High Level Sewer.

- Annual nonstorm flow to the plant by the year 2020 is expected to average approximately 480 mgd, based on average flow of 390 mgd during low groundwater conditions and 670 mgd during high groundwater conditions. Low groundwater conditions are generally defined as the period from late spring through early winter. High groundwater conditions occur generally during the late winter - early spring period.

- On the average day, the capacity of the plant to accept stormwater, either directly or as CSO return flows, will vary from about 600 to 880 mgd, depending on the time of the year. During maximum day wastewater flow conditions, the capacity to accept stormwater will vary from 320 to 550 mgd, depending on the time of the year.

- A sensitivity analysis of flows was performed which indicated that the total flows are most sensitive to the volume of infiltration/inflow entering the system. System management can be structured to compensate for any unanticipated increase in domestic or nondomestic wastewater flow, through reductions in I/I.

- Average daily nonstorm loadings of total suspended solids and biochemical oxygen demand are expected to increase about 12 percent to 570,000 lb/day of BOD and 515,000 lb/day of TSS over the planning period. These increased loadings are attributable to increases in wastewater flow. Maximum daily BOD and TSS loadings are expected to be 2.0 and 2.1 times the average, respectively. During storm conditions, additional loadings will reach the plant. The total suspended solids loading rate from stormwater will increase the wastewater loadings by approximately 400,000 lb/day. The biochemical oxygen demand loading rate from stormwater will increase the wastewater loadings by approximately 165,000 lb/day.

- Nonconventional pollutant loadings (metals, acids and base neutral organics, VOCs, pesticides, and PCBs) to Deer Island will increase in the future in proportion to the increase in future wastewater flow to the plant (approximately 15 percent) and the degree to which combined sewer overflows are captured. For selected nonconventional pollutants, the CSO increase ranges from a few percent to up to 25 percent compared to existing loadings, assuming that all CSOs are captured and returned to the plant.

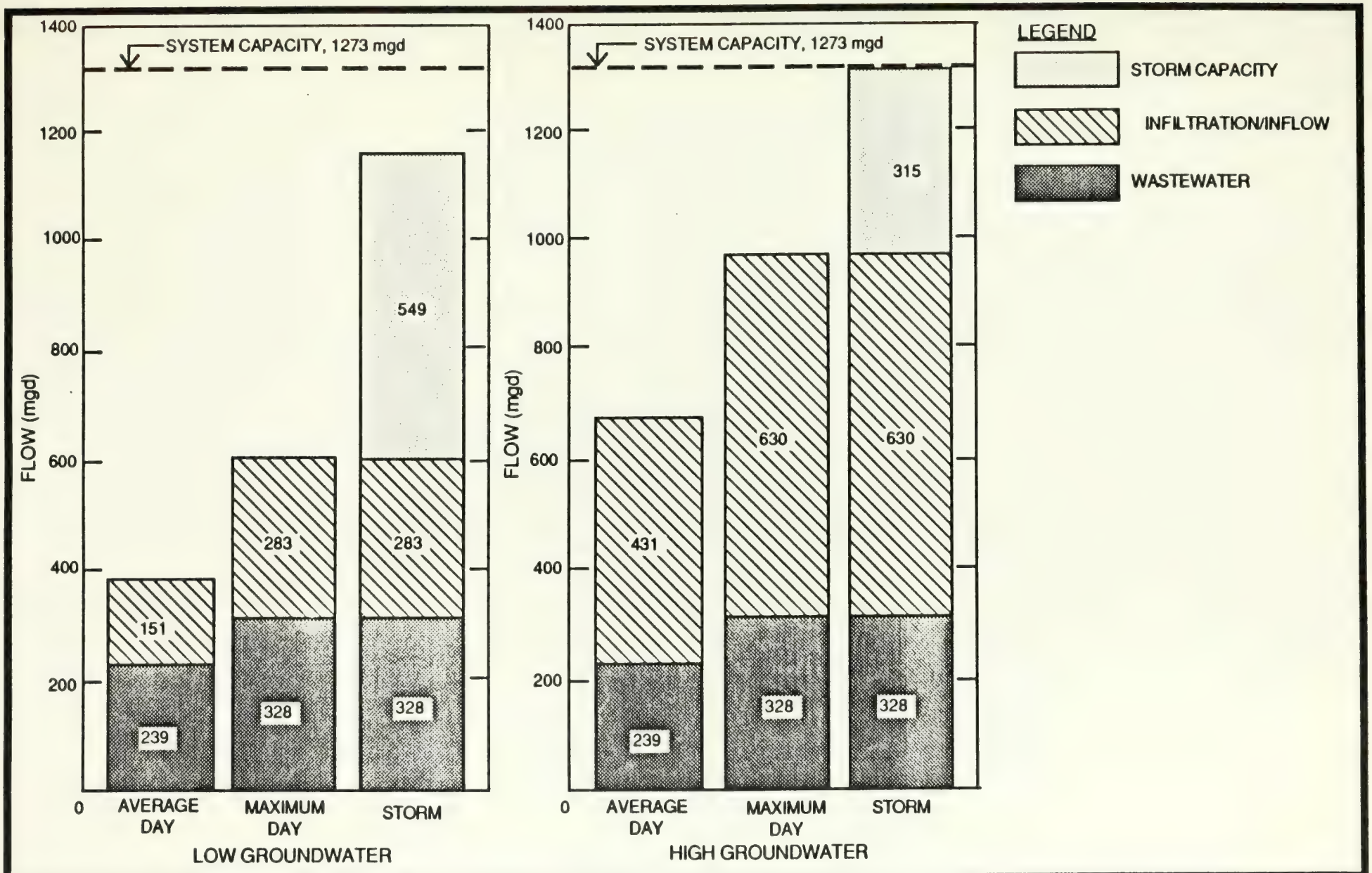
A summary of the projected flows (rounded to the nearest 10 mgd) and loadings is presented in Table 6.6-1. Figure 6.6-1 summarizes the design year flow, by components, for low and high groundwater conditions.

TABLE 6.6-1

SUMMARY OF DESIGN YEAR (2020) FLOWS AND LOADING

	Low Groundwater Conditions		High Groundwater Conditions	
	Average Day	Maximum Day	Average Day	Maximum Day
Non-Storm Conditions				
Total Wastewater (mgd)	390	600	670	950
BOD (1000 lb/day)	570	1140	570	1140
TSS (1000 lb/day)	515	1080	515	1080
Storm Conditions				
Total Wastewater (mgd)	---	600	---	950
Stormwater (mgd)	---	550	---	320
Total (mgd)	---	1150	---	1270
BOD (1000 lb/day)	---	1305	---	1305
TSS (1000 lb/day)	---	1480	---	1480

(Annual Average Flow is 480 mgd based on 4 months of high groundwater conditions and 8 months of low groundwater conditions)



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 6.6 -1
SUMMARY OF DESIGN YEAR FLOWS AND LOADS

7.0 ENVIRONMENTAL REVIEW

7.1 PREVIOUS REVIEWS

7.1.1 INTRODUCTION

Public concern about the quality of Boston Harbor water, and the odor and health problems caused by the discharges of raw and untreated sewage into the near-shore areas dates back to the first half of the 19th century. However, it was not until the first half of this century that the first studies were conducted in an attempt to remedy the overall situation.

By the mid 1930s, public consternation about the Harbor's water pollution problem prompted the creation of a "Special Commission on the Investigation of the Discharge of Sewage into Boston Harbor and its Tributaries." The Commission, which made detailed studies of the effects of the Nut Island, Deer Island, and Moon Island raw sewage discharges, concluded that the Harbor could assimilate the sewage if primary treatment were used to remove floating solids and if the outfalls were extended further out into the Harbor to stop the build-up of sludge deposits that was occurring.

In response to the Commission's report, and in compliance with its recommendations, steps were taken to install primary treatment and to extend the outfall lines so that both treated effluent and processed primary sludges could be discharged further out into the Harbor.

Construction of the primary treatment works at Nut Island was completed in 1952. Sixteen years later, in 1968, the Deer Island plant, which also handles the flow from Moon Island, went on-line.

Despite the construction of these facilities, however, the quality of water in Boston Harbor continued to receive attention and scrutiny by both federal and state officials.

7.1.2 THE DEEP TUNNEL PLAN FOR CSOs

In 1967, a year prior to the completion of the Deer Island project, the City of Boston hired a consultant to find a solution to the City's combined storm-sanitary sewer overflow (CSO) problem. The project recommended by the City's consultant--a "Deep Tunnel" which would store excess flows for later treatment--was never implemented because of its $430-million cost.

7.1.3 THE FEDERAL ENFORCEMENT STUDY

In 1968, the year the Deer Island plant came on line, a federal study was released charging that almost one-third of Boston Harbor was "grossly polluted." This report triggered a series of three federal "Enforcement Conferences" on Boston Harbor, the first in that same year, 1968 and the last in 1971.

7.1.4 EARLY STATE STUDIES

During this same three-year period, the Massachusetts Division of Water Pollution Control (DWPC) also conducted a number of studies on Boston Harbor. Certain of these studies claimed that the treated primary effluent itself did not have an adverse effect on the Harbor's water quality. However, another study, released in 1971, claimed that the historical practice of discharging digested sewage solids with the effluent on the outgoing tide was causing harmful quantities of sludge to accumulate on the Harbor floor.

The series of Federal Enforcement Conferences and the 1971 analysis of the sludge deposit problems led to two major and more far-reaching studies. One of these was the "Boston Harbor Eastern Massachusetts Metropolitan Area Wastewater Management and Engineering Study" (EMMA). EMMA resulted from an agreement among the parties to the Federal Enforcement Conferences--the MDC, the Massachusetts DWPC, and the U.S. EPA--to make a comprehensive review of the Harbor's water pollution problems and to set out just what would be required to clean it up. The other study, stemming from a separate agreement between the MDC and the DWPC, was designed to develop an acceptable method for disposing of the wastewater sludges from the Nut and Deer Island plants.

7.1.5 THE EMMA STUDY

Taking just over three years to complete, the purpose of the EMMA study was to provide a 50-year master plan for the MDC's sewerage system and treatment facilities. Among the subjects to be addressed were the long-term operation and capital maintenance requirements of the MDC's sewerage and treatment system, and an assessment of the additional system capacity that would have to be constructed to service future growth in the area.

In October, 1972, Congress enacted the "Federal Water Pollution Control Act Amendments," (P.L. 92-500) (FWPCAA), which caused the scope of the study to be further expanded. In anticipation of the new law's requirements, the EMMA study included options that would allow the MDC to comply with the new statute's municipal clean-up requirement of secondary treatment--a level of treatment capable of removing approximately 85 percent of the pollutants in raw wastewater.

When they were released in the spring of 1976, the EMMA study's recommendations proved to be highly controversial. At issue were the plan's recommendations for full secondary treatment of flows to the Nut and Deer Island plants, and for two new advanced waste treatment (AWT) satellite plants that would discharge to the Charles and Neponset Rivers.

7.1.6 ASSESSING THE IMPACT OF THE EMMA STUDY RECOMMENDATIONS

EPA decided that an environmental impact statement (EIS) should be prepared on the EMMA study recommendations before any of the 52 projects proposed by the plan were implemented. However, long before the EIS process was completed, one of the proposed projects--to provide secondary treatment capacity at Nut Island--was effectively eliminated by an act of the state legislature.

In order to expand and upgrade the Nut Island facilities, approximately 28 acres of Quincy Bay would have to be filled in. Public opposition to this was so strong that, in 1977, the Massachusetts legislature passed a bill that precluded any such activity, at least for the purpose of building a wastewater treatment plant. Without the additional "land," the Nut Island recommendation was effectively killed.

Two other projects, the AWT satellite plants, were eliminated by EPA during the EIS development process. Mathematical models used to assess the impact these two projects would have on the Neponset and Charles Rivers indicated that water quality would be adversely, rather than beneficially, affected. Consequently, these two projects were effectively eliminated from further consideration.

Yet another analysis showed that the cost of correcting the problems at the Nut Island primary facility was almost equal to the cost of building a completely new primary treatment unit. Consequently, there was little that EPA could do except to look at consolidated approaches to solving the Harbor's water pollution problem.

When it was issued in September, 1978, the draft final EIS recommended that both primary and secondary treatment of all wastewater flows be provided at Deer Island. However, this plan proved to be no less controversial to area residents than prior approaches.

Chief among the concerns of area residents was the additional stress that this new project would place on their already overburdened environment. This was particularly true for residents of the town of Winthrop, who were already burdened with noise from Logan Airport, odors from the existing Deer Island plant, and the presence of the Suffolk County House of Correction, also on Deer Island. As a result, EPA was not able to finalize the EIS, and the matter languished.

7.1.7 OCEAN DISCHARGE WAIVER APPLICATION STUDIES

At the same time that EPA was preparing the EIS, the MDC was undertaking studies and reviews to take advantage of a newly adopted provision of the Federal Clean Water Act. The amendment, one of several adopted by Congress in 1977, authorized EPA to grant waivers from the law's minimum secondary treatment requirement to communities discharging to marine or ocean waters.

The new provision, often referred to by its section number in the amended statute--301(h)--would allow coastal communities to apply less than full secondary treatment to their wastewater discharges as long as certain environmental safeguards were assured. To obtain the waiver, communities were required to show that:

- There were applicable water quality standards for the affected waters;
- The lower level of treatment would not hinder the attainment of the Act's "fishable/swimmable" goal;

- o A system for monitoring the effects of the discharge that would occur had been established;

- o The reduced level of treatment would not impose greater levels of treatment or other types of pollution controls elsewhere;

- o All germane industrial pretreatment requirements would be enforced;

- o A program and schedule for eliminating toxic pollutants from the discharge existed; and

- o There would be no increases in the levels of the pollutants in the discharge, once the permit was granted.

In order to illustrate its ability to comply with these statutory caveats, the MDC initiated a study in 1978, and appended the resulting report to its "301(h) waiver" application when it was filed with EPA on September 13, 1979. Three addenda to the application were submitted in 1982. In June, 1983, EPA tentatively denied the application.

In mid-1984, the MDC submitted a revised application for the section 301(h) waiver, and a few months later, in October, 1984, submitted yet another addendum in further support of its final attempt to obtain the waiver.

On March 29, 1985, U.S. EPA tentatively denied the granting of the 301(h) waiver to the MDC, on the grounds that any level of treatment less than secondary was likely to impair water quality and adversely affect the Harbor's marine ecosystem. In its decision document, EPA also claimed that the MDC's programs and submissions for addressing the waiver section's requirements for monitoring, pretreatment enforcement, and the control of toxics, were deficient in one way or another. Accordingly, EPA determined that the MDC should proceed with the implementation of full secondary treatment as called for by the federal law.

7.1.8 THE PHASE 1 SITE OPTIONS STUDY

In April of 1978, EPA and the MDC entered into an agreement that was intended to have the MDC move forward with certain projects that would be required regardless of the outcome of the pending EIS or the 301(h) waiver application. Consequently, in accordance with this agreement, the MDC initiated a two-phase facilities planning effort. The purpose of the first phase was to identify the various options for locating the treatment facilities that would be required, depending on the level of treatment ultimately determined to be necessary.

In June, 1982, the MDC issued its consultant's report on the "Phase 1 Site Options Study." With regard to the short term, the study concluded that the "existing MDC primary treatment facilities at Deer Island and Nut Island are in need of immediate upgrading to improve

wastewater treatment at each facility." With regard to the long term, however, the study confirmed the need "to provide the substantial facility improvements necessary for future treatment needs and protection of Harbor resources," and to set forth twelve siting options. Seven of the options involved secondary treatment with local outfalls, 2 involved upgraded primary treatment with a new deep-ocean outfall equipped with diffusers, and 3 involved upgraded primary treatment with diffused local outfalls. Generally, each option involved the use of space at Deer Island, Nut Island, or Long Island, or some combination of the three.

In addition to identifying the available options, the Phase 1 report also provided a general characterization and evaluation of each option. However, the report stopped short of making an actual recommendation, due in part to the fact that the 301(h) waiver application was still pending.

7.1.9 THE SUPPLEMENTAL DRAFT EIS

At about the same time that the MDC's consultant was completing the Phase 1 Site Options Study, EPA elected to update the earlier Draft EIS that had been prepared on the EMMA study recommendations, but had never been completed. This time, however, the review would focus on the options presented in the Phase 1 Site Options Study.

Finished in December, 1984, and released in January, 1985, the "Supplemental Draft Environmental Impact Statement" (SDEIS) provided assessments of 7 alternatives, having first expanded the Phase 1 Site Options Study's list of 12 options to 22. Included among the new options were two that would consolidate all of the treatment on Long Island; a new "satellite" AWT treatment facility that would discharge into area wetlands for effluent polishing; and a proposal that would locate facilities on new man-made sites in the outer Harbor area. Again, however, no decision was made recommending any particular option. There were several reasons for this.

First, and perhaps most significantly, EPA and state officials were aware of the strong feelings about this entire matter among the public in general, and the Commonwealth's legislators in particular, and therefore were cognizant of the need to provide an additional opportunity for public review and comment. Further, given that the door had already been opened to the public at the beginning of the SDEIS process via the of "Public Scoping Meetings," and that these meetings had in fact led to the inclusion of several new options, it was deemed both prudent and necessary to continue to allow the public to be an integral part of the review and assessment process.

Second, EPA officials felt that prior to selecting a preferred site, a set of selection criteria should be developed. Accordingly, they elected to use the SDEIS as the vehicle for accomplishing that objective.

Third, EPA had yet to make a decision with respect to the MDC's 301(h) ocean discharge waiver application. Because the level of treatment had a significant bearing on the acceptability of, or need for, one option over another, it was virtually impossible to choose the "best" configuration of facilities prior to reaching a decision on the waiver issue.

Yet another factor was the need to give consideration to issues other than those directly linked to water quality. Therefore, in addition to the environmental, social, and economic criteria normally used in this process, EPA also assessed the legal, institutional, and political ramifications of each option. In doing so, it was found that all of the options were deficient in one way or another. Each had at least one significant, adverse impact on the interests of one group or another, and none of them satisfied all of the screening criteria.

Selecting Seven Options

Without a clear set of preferential options, EPA proceeded to shorten the list by selecting those with the most advantageous characteristics. Initially, this led to the selection of eight options, four involving secondary treatment and four with primary treatment. Additional evaluations, however, eliminated one of the primary options, that of providing all primary treatment on Long Island. The reasons for this included: the need for 52 acres of land; significant legal and institutional obstacles; an adverse impact on a planned state park and the existing Chronic Disease Hospital; construction constraints; and costs that would be significantly greater than those for the other primary options.

Imposing Conditions on Alternate Sites

Having selected what it believed to be the most viable approaches, EPA was then faced with the task of determining what "conditions" would be necessary for each of these seven options, which included:

1. Providing full secondary treatment of all flows at Deer Island, with a local (short) outfall;

2. Splitting the provision of secondary treatment between the Deer Island and Nut Island plants, both with local outfalls;

3. Providing full secondary treatment of all flows at a new Long Island site, with both plants using local outfalls;

4. Splitting the provision of secondary treatment between the Deer Island and Long Island sites, again using local outfalls;

5. Providing primary treatment of all flows at Deer Island with a long outfall;

6. Splitting the provision of primary treatment between Deer Island and Nut Islands with a long outfall serving both facilities; and

7. Splitting the provision of primary treatment between the Deer Island plant and a new, smaller primary facility at Long Island: again, with a long outfall serving both facilities.

A source of concern was the identification of mitigation measures that would be necessary in order to minimize identified adverse site impacts which were unavoidable, but, nonetheless, unacceptable, including:

- o The impact of transporting massive quantities of materials to the respective construction sites;
- o The effects of large numbers of site workers converging on already congested, relatively residential areas each day;
- o The effects of construction noise on area residents in neighborhoods immediately adjacent to or near the proposed project sites; and
- o The need to minimize and control odors from the existing plant sites, especially during the construction periods.

With respect to the transportation-related issues, EPA required that materials be barged to the site, and that construction buses be provided to bring construction workers in from outlying locations, thus avoiding extra vehicular traffic and its accompanying noise in adjacent neighborhoods.

With respect to the concerns about construction noise, EPA made several stipulations. These included the use of equipment mufflers, and the use of equipment specially designed to minimize noise during use. EPA also stipulated that all work was to be performed in compliance with local area noise control ordinances.

EPA also stipulated that the MDC utilize odor control equipment at all of the respective sites, and, in the case of the Long Island secondary treatment option, that the local area hospital be relocated.

As noted previously, EPA also intended that the SDEIS be used to establish the criteria with which each option would be rated. Accordingly, when the Agency issued the SDEIS for public comment, it proposed that each option be rated with respect to:

- o Its effect on the quality of the overall Harbor environment;
- o Its impact on area neighborhoods, and neighboring groups or institutions;
- o The impact on area natural resources and cultural characteristics;
- o The extent to which it could be reasonably and expeditiously implemented;
- o Its cost-effectiveness and its affordability;

- o Its costs; and

- o The actual (or at least perceived) reliability of the option.

In addition to addressing the various impacts of the alternate treatment plant sites, the SDEIS also identified certain issues which, while not having a material or limiting impact on site selection, were nonetheless significant in their own right. Foremost among these was the question of how to handle the disposal of the solids, or sludges, that would be generated by the expanded treatment facilities, regardless of the option chosen. The reasons for this level of concern stem from earlier studies and assessments.

Environmental Assessments of Sludge Management Options

About the same time that the EMMA plan was being developed, the MDC, pursuant to its agreement with the State Division of Water Pollution Control, was conducting a separate review and assessment of sludge disposal options. The resulting "Sludge Management Plan," which was made public in 1973, recommended incineration of all sludges at the Deer Island plant site as the most environmentally sound option.

The MDC, intent on obtaining a federal grant to help pay for the costs of constructing the proposed incineration facility, prepared an environmental impact report (EIR) and submitted it to the U.S. EPA for review. Citizen opposition to the plan at an April, 1975 hearing, along with EPA's own misgivings about incineration, prompted EPA to prepare a full environmental impact statement (EIS) on the contemplated sludge incineration project.

The EIS was completed in February, 1976, just weeks before the EMMA study's results were made public, and confirmed the initial finding that incineration was environmentally more desirable than any other option, including land application or ocean disposal.

In compliance with the requirements of the Massachusetts Environmental Policy Act (MEPA), EPA forwarded its draft EIS on the sludge disposal plan to the state's Secretary of Environmental Affairs for further review. This time, however, the project did not fare as well. Arguing that the original study's examination of the alternatives to incineration had been deficient, the Secretary's office decreed that further study of the land application and other sludge disposal options would be necessary before it could approve the project.

The New Sludge Management Plan

Three years later, with the additional information in hand, EPA once again concluded that incineration continued to offer the most environmentally sound option for disposal of the Nut Island and Deer Island Treatment Plant sludges. However, when it released the draft of the final EIS in March of 1979, EPA stipulated that before proceeding, the now 6-year-old Sludge Management Plan should be updated.

Many area residents, as well as the Massachusetts Environmental Affairs Secretary's Office were still strongly opposed to the project, and the new draft EIS did little to alter their position. At issue were allegations by the public that the potential implications of air pollution from the incinerator had not been adequately taken into consideration. The Environmental Secretary's Office was also concerned that the data used to evaluate both the incineration and sludge composting options were insufficient for drawing the stated conclusions. Accordingly, the Secretary decreed that the project was not in compliance with the state's MEPA statute, and efforts to remedy the residual solids (disposal) problems languished until the present.

MWRA is currently working to complete a Long-Term Residuals Management Facilities Plan which is scheduled for completion in 1988. (See Section 3.3 in this Volume.)

7.2 THE MEPA PROCESS

In response to MWRA's June, 1986 filing of the Environmental Notification Form (ENF), in November of 1986 the Commonwealth of Massachusetts Secretary of Environmental Affairs issued a certificate establishing the proposed Secondary Treatment Facilities as a "Major and Complicated" project. The text of that certificate follows:

November 21, 1986

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ESTABLISHING THE SPECIAL PROCEDURE FOR A
MAJOR AND COMPLICATED PROJECT

PROJECT NAME	Deer Island Wastewater Treatment Facilities Plan and Construction
PROJECT LOCATION	Winthrop, Boston, Quincy, and Chelsea
EOEA NUMBER	6136
PROJECT PROPONENT	Massachusetts Water Resources Authority (MWRA)
DATE NOTICED IN MONITOR	July 9, 1986

This project entails the planning for construction of a secondary wastewater treatment facility at Deer Island to which sewage flows from the northern and southern metropolitan sewerage districts will be transported for treatment and disposal. Planning encompasses preliminary treatment at four remote headworks facilities, transport from these facilities to Deer Island, provision of primary and secondary process facilities and sludge transfer facilities, and transport to and disposal at an outfall site located in Boston Harbor/Massachusetts Bay. The MWRA will assess alternatives for each project element and

select a recommended plan for implementation. The MWRA will assess the environmental impacts of the alternatives and the recommended plan and will develop a mitigation program to limit adverse effects during construction and operation.

The MWRA requested in the Environmental Notification Form (ENF) that the project be designated as Major and Complicated under the provisions of 301 CMR 10.10. In my Certificate on the ENF, issued August 8, 1986, I agreed to this designation. Accordingly, pursuant to the M.G.L.C.30,s.62A, I establish herewith a special procedure for evaluation and review of the above project.

BACKGROUND

The Deer Island Facilities Plan (DIFP) is one of a number of related activities leading to the cleanup of Boston Harbor. Following the completion of a Final EIR on wastewater facility siting (EOEA #4911), the MWRA chose Deer Island as the site for a new secondary wastewater treatment plant. Near term improvements of the existing treatment system are currently underway through the Fast Track Improvement Program (EOEA #5041) designed to restore the Deer Island and Nut Island Facilities to their original functioning capacities. Facilities planning and environmental reviews for Residuals Management (sludge, scum, grit and screenings) and Water Transportation Facilities (site access) are currently being prepared under separate projects. For Residuals Management Facilities Plan refer to EOEA #5832 and for Water Transportation Facilities Plan refer to EOEA #5938 (on island facilities) and EOEA #5939 (on shore facilities).

By Federal Court decree, the MWRA must have a completed Facilities Plan for this project by December, 1987, a completed Environmental Review by February, 1988, and must accept a Final Plan by May, 1988. Contingent upon the findings of this planning and review process, the Court has further ordered that the new primary treatment facilities be operational by 1995, including a new under harbor transmission tunnel and ocean outfall, and that new secondary treatment facilities be operational by the end of the century.

STUDY DESIGN

The Court schedule requires that the MWRA undertake an unusually efficient planning, design, and environmental review process. The MWRA has suggested that the project be divided into four major efforts:

1. Early site preparation;

2. Construction of an interisland transport conduit from Nut Island to Deer Island;

3. Construction of an outfall conduit from Deer Island to a discharge structure in Boston Harbor/Massachusetts Bay; and

4. Selection of treatment alternatives and plant construction.

In order to meet construction deadlines, the MWRA proposes to begin the site preparation early and has asked for expedited review of this component of the overall project.

The analysis, design, and review efforts have been divided into 21 major work tasks.

SCOPE REVIEW

Each of the 21 work tasks are further subdivided into work packages for which descriptions of the scope of work are to be developed. These work package scopes shall, after thorough review, serve as the scope for the MEPA review of this project.

The MWRA must provide the work package scopes to my office, to the Citizens Advisory Committee, and to interested agencies and other parties. Notice of the availability of these will be published in the Environmental Monitor and comments will be received for 30 days, after which I shall issue within seven days a statement adopting, or adopting with modifications, these scopes.

SCHEDULE

The study design calls for the preparation and review of separate reports on each task and on some sub-tasks prior to the completion of the draft and final facilities plan and environmental review documents. Many of these reports amount to interim drafts of material to be incorporated into later reports. Thus, I do not propose to review under MEPA all of the reports prepared during this effort. Rather, I have identified key reports that must be filed with MEPA and undergo full review. These comprise the scopes of work discussed above, several of the basic data reports, and environmental review documentation on site preparation, interisland conduits, the ocean outfall, and the treatment plant.

The schedule calls for an accelerated review and MEPA approval of only the Site Preparation component of the project at this time. Timing of the draft documents for the environmental review of the outfall, interisland conduit, and treatment components of the project may be staggered as the project develops. Milestone dates as currently envisioned, and court mandated dates for environmental review are listed below:

1.	Proposed Work Package Scopes	Jan	1987
2.	Draft Evaluation Criteria	Feb	1987
3.	Draft Power Supply and Utilities Plan	Mar	1987
4.	Draft Waste Characterization	Jun	1987
5.	Draft Mitigation Planning	Jun	1987
6.	Draft Flow and Loadings	July	1987
7.	Draft Performance Criteria	July	1987

8.	Draft Site Preparation Env. Review	Aug	1987
9.	Draft Interisland Conduit Env. Review	Sept	1987
10.	Draft Treatment Alternatives Env.	Sept	1987
11.	Draft Outfall Environmental Review	Sept	1987
12.	Final Site Preparation Env. Review	Oct	1987
13.	Draft Environmental Impact Report	Oct	1987*
14.	Final Environmental Impact Report	Feb	1988*

*Federal Court Mandated Dates (Subject to confirmation based on filing by the MWRA on November 14, 1986)

Each of these documents shall be submitted to me for review, notice shall be published in the Environmental Monitor, and they shall made available for a 30-day agency and public review and comment period. A seven day period for my comment shall follow the close of the public comment period. My comments, and others received during the review period, shall be responded to in the next document dealing with a particular subject.

CITIZENS' ADVISORY COMMITTEE

To ensure that important policy decisions will be made in the context of maximum public knowledge and participation, this Special Procedure requires the formation of a Citizens' Advisory Committee (CAC). The CAC will provide advice, recommendations and input into decisions made by me and by the MWRA's facilities planners on both the Deer Island Secondary Treatment and the Residuals Management (EOEA #5832) Facilities Planning projects. Through a nomination process that began in July, 1986, members have been selected to represent a balance of interests so as to fulfill the requirements under both MEPA and the construction grants program administered by DWPC. In addition, personnel from concerned state and federal agencies participate as non voting members of the CAC.

The CAC will have the ability to form subcommittees based on a need to review certain issues and to examine local concerns, particularly with regard to potential sites to be named in the RMFP. The Committee will meet on at least a monthly basis, and the authority's staff and consultants will be available to conduct workshops and subcommittee meetings on topics the CAC deems necessary.

The MWRA shall provide to the CAC copies of all documents produced as part of the study. These may be commented upon by the CAC at the monthly meetings or in writing directly to the MWRA. In addition, each document to be submitted for MEPA review will be provided to the CAC at least 30 days prior to submission. Written comments by the CAC on such documents will be attached to the document and made part of the submission.

It is my intention that members of the CAC shall not be deemed "special state employees" within the meaning of G.L.C. 268A. To that end, I provide that the CAC shall be constituted informally, shall exist only during the time required to address this project, shall serve without compensation, shall not expend public funds, and shall not be required to issue formal reports or conclusions. Nothing in this charge shall limit the provision

of support services to the CAC by the MWRA nor shall it limit the CAC's ability to comment to and advise me during this effort.

The Authority may also wish to establish a Technical Advisory Committee of agency reviewers and independent experts. This group, which should be a small, select committee, can provide agency expertise and scientific peer review to the MWRA with respect to certain elements of these projects; notably the siting of the secondary effluent discharge point. This would go far to assure that the highest technical standards are adhered to and counter any potential suspicion of bias in the results of these efforts.

(Signed)

November 21, 1986 — James S. Hoyte, Secretary

December 14, 1986 — Michael Gritzuk, MWRA

APPENDIX A

SECONDARY TREATMENT FACILITIES PLAN

PROJECT WORK PACKAGES

Approved: _____
MWRA

_____
CDM/S&W

Date: _____

Rev: 5

WORK SUMMARY: M - PROJECT MANAGEMENT

WORK GROUP: MA-01 PROJECT MANAGEMENT

WORK PACKAGES: MA-01A PROJECT MANAGEMENT
MA-01B MANAGEMENT INFORMATION SYSTEMS
MA-01C PURCHASING CONTRACT ADMINISTRATION
MA-01D RECORDS MANAGEMENT

I. DESCRIPTION OF SCOPE

The scope of this work group is to provide the overall project management required to coordinate with MWRA and team members to ensure that the project is completed on time, within budget and with high standards of quality. The major work packages and associated tasks included within this work group include:

A. Project Management

1. Project Organization - finalize the organization of the project team, finalize a detailed workplan for the project and issue project administration procedures and directives to facilitate the day-to-day activities of the Project.

2. Project Scheduling - prepare a project schedule using a bar chart format. The schedule will be based on the detailed work plan and maintained throughout the duration of the project.

3. Project Orientation - conduct workshops and briefings to familiarize team members and MWRA staff with the detailed workplan and project schedule.

4. Project Management - direct team members, coordinate project tasks and other MWRA projects, control project budgets and

schedules, attend meetings and briefings and review and approve work products. Institute a management information system to track manhours and budgets for each work package.

5. Progress Reporting - prepare monthly progress reports summarizing progress to-date and activities requiring special attention, estimate time and budgets to completion, and monitor MBE/WBE participation and significant events scheduled for the ensuing month.

B. Management Information System (MIS)

1. MWRIS Tracking System - develop computer application to control project budgets and team assignments, and to assist in monthly invoicing. Tracking system will be developed for all work packages on an individual basis and will include all team members.

2. Schedules - computer assisted scheduling programs (e.g. CPM).

C. Purchasing Contract Information

(Scope has been deleted for this work package and the budget reflects this omission).

D. Records Management

1. Records Management - prepare and maintain project files, drawings, data and a project library. Deliver all these items to MWRA upon project completion.

II. TASKS AND ACTIVITIES

The tasks and activities within this work package include:

A. Project Management

1. Project Organization

a) develop a proposed organization chart for the project team and obtain MWRA approval
b) identify key staff for the project and obtain MWRA approval of key staff; request MWRA approval for changes or additions to the key staff as the project proceeds
c) develop a detailed workplan for the project. obtain MWRA approval of the work packages, and identify any changes

that may be required in the work packages as the project proceeds

2. Project Scheduling

   a) overlays will be prepared for use with the bar chart or with individual work package schedules to insure overall project coordination

3. Project Orientation

   a) conduct orientation workshops to familiarize the project team and MWRA staff with the project scope, schedule, detailed workplan, work products and key project issues.

4. Project Management

   a) coordinate project tasks with project staff and consultants, MWRA staff and MWRA Board of Directors
   b) coordinate project activities with other, related MWRA projects and consultants, as more specifically described in Task MQ-02A
   c) review and approve project correspondence
   d) prepare and review and approve project invoices
   e) prepare, review and approve memoranda and interim, draft and final reports
   f) develop and execute the quality assurance program and procedures (See Work Package MA-01E)
   g) develop and maintain a project CPM and updated monthly gantt chart

5. Progress Reporting

   a) conduct weekly project status meetings.
   b) prepare and submit monthly project status reports that include as a minimum:

      - items requiring immediate attention
      - project status indicating tasks underway and their percent completion as well as tasks completed
      - budget status summarizing costs incurred to-date and estimated costs at completion versus budget
      - significant upcoming activities and events
      - MBE/WBE participation.

   c) prepare for and participate in periodic briefings of the MWRA Board of Directors and Board Sub-Committees.

B. Management Information Systems

1. MWRIS Tracking System

a) control project budgets, schedules and team assignments, utilizing a specially designed MIS

2. Schedules

a) maintain computer schedules based on a CPM analysis for all work packages.

C. Purchasing Contract Administration

(There are no tasks and activities associated with this work package because this work package has been deleted.)

D. Records Management

a) Set-up and maintain a central project file, drawings library, data storage and a project library. At project completion, return all files and library materials to MWRA.

III. WORK GROUP PRODUCTS

The work products to be produced by this work group include:

1. Project organization chart
2. Detailed project workplan
3. Project orientation workshops
4. Project budgets
5. Project schedules
6. Monthly progress reports
7. Project meetings and briefings

IV. REQUIRED INPUTS

Required inputs include:

1. Contract scope of services and contract schedule
2. MWRA review comments
3. MWRA administrative procedures

V. RESPONSIBILITY

The responsibility for overall project management lies with Richard Fox. Responsibility for the management of each of the project's functional areas is assigned to: Bill Callahan-Engineering; John Gall-Institutional; and Jean McCluskey-Environmental. Assistance to all managers will be provided by Doreen Zankowski, Project Coordinator.

Approved: _____
MWRA

_____
CDM/S&W

Date: _____
Rev: 2

WORK SUMMARY: A - PROJECT MANAGEMENT

WORK GROUP: MA-01 PROJECT MANAGEMENT

WORK PACKAGE: MA-01E TECHNICAL/PROJECT REVIEW

I. DESCRIPTION OF SCOPE

The purpose of this work package is to develop and implement a quality control and quality assurance program to provide timely technical review of the facilities planning effort. The major subtasks for this work package include:

A. Develop QA/QC Program. A program for quality control and quality assurance will be developed to provide appropriate and timely technical reviews for the project, including the establishment of review committees.

B. Technical Review Committee. The TRC will consist of senior members of CDM/S&W and MWRA and will provide a review of the technical analyses and conclusions of the facilities plan.

C. Operations Review Committee. The ORC will consist of senior operations specialists from CDM/S&W, MWRA and other similar wastewater agencies, and will review the operability and preliminary plan of operations to provide a strong operator input into the facilities plan.

II. TASKS AND ACTIVITIES

The tasks and activities included within this work package include:

A. Develop QA/QC Program

1. Review the detailed workplan and schedule for the facilities plan preparation
2. Prepare a quality control/quality assurance plan to ensure that work products and analyses are performed in a professional, high quality manner and within the court mandated milestones
3. Present the QA/QC workplan to MWRA for review and comment and incorporate these comments into a final plan

B. Technical Review Committee

1. Identify five key dates for the review of technical analyses and conclusions/recommendations
2. Identify proposed members of each TRC and seek MWRA approval of the committee make-up
3. Schedule, conduct and prepare minutes of five TRC meetings

C. Operations Review Committee

1. Identify four milestones for the review of operations related activities
2. Identify proposed members of the ORC and seek MWRA approval of the committee members
3. Schedule, conduct and prepare minutes of four ORC meetings

III. WORK PACKAGE PRODUCTS

The work package products include:

1. QA/QC plan for the facilities plan
2. Meetings and minutes of meetings of the TRC
3. Meetings and minutes of meetings of the ORC

IV. REQUIRED WORK PACKAGE INPUTS

Inputs required to complete this work package include:

1. Detailed work plan and schedule

Approved: _____
MWRA

_____
CDM/S&W

Date: _____
Rev: 5

WORK SUMMARY: M - PROJECT MANAGEMENT AND COORDINATION

WORK GROUP: MQ-02 - COORDINATION PROGRAM

WORK PACKAGE: MQ-02A-COORDINATION PROGRAM

I. DESCRIPTION OF SCOPE

The scope of this work package encompasses the overall effort required to coordinate this project work with other MWRA project work, and with non-MWRA projects that could significantly impact the implementation of the facilities plan. The scope also includes the preparation of a summary of the issues that are expected to be addressed by this or other facilities planning efforts and associated environmental reviews.

This work package includes the following subtasks:

A. Coordination with Other MWRA Projects. A coordination program will be developed to ensure that the project team is aware of the scope, objectives, schedule and recommendations of related MWRA projects.

B. Coordination with Non-MWRA Projects. A coordination program wil be developed to provide the project team with information describing the scope, schedule and recommendations of non-MWRA projects that could have significant impact on the implementation of the facilities plan (e.g. Third Harbor Tunnel, Depression of the Central Artery, Prison Relocation).

C. Summary of Issues. A summary of all outstanding issues that were identified during MWRA's decision-making process for the siting of the new treatment facilities and the associated environmental reviews (EIR/EIS), as well as the issues

identified during the federal court litigation, will be prepared. Those issues to be resolved in this facilities plan will be identified, including any work packages or work products that will be used to resolve these issues. The summary will also include an approximate schedule when the identified issues are expected to arise and if appropriate, any action required by the MWRA Board.

D. Coordination with Local Technical Representatives. This task will facilitate the flow of information to and discussion with technical representatives from the most significantly impacted communities.

II. TASKS AND ACTIVITIES

Work package tasks and activities include:

A. Coordination with MWRA Projects

1. Review data from WP DB-20A, Previous Studies, review MWRA court filings and federal court rulings, and review the MWRA capital improvement program to identify ongoing and planned projects.

2. Meet with MWRA and other agencies and consultants designated by MWRA to identify related projects, their scopes, schedules, milestones and recommendations. Any discussions with the regulatory agencies will also be used to prepare the agency review schedule described in WP PR-61A.

3. Prepare and review with MWRA a memorandum summarizing the coordination planned between this project and each of the following projects:

    a. Water Transportation Assessment Study
    b. CSO Studies
    c. Residuals Management (Interim and Long-Term)
    d. Deer Island Fast Track Upgrade Projects
    e. Nut Island Immediate Improvement Projects
    f. Southern System Modelling Study
    g. Industrial Pretreatment Program
    h. Ongoing Court Related Activities

4. Prepare for, attend and prepare minutes of up to twelve

coordination meetings.

B. Coordination With Non-MWRA Projects

1. Identify projects which may significantly impact implementation of the facilities plan and meet with the responsible implementing agency/owner when requested by MWRA. Such projects will include but not be limited to:

    a. Prison Relocation
    b. Massport Marine Facilities Plan
    c. Central Artery Depression
    d. Third Harbor Tunnel
    e. Waterfront Development
    f. Significant Collection System Projects in the Cities and Towns of MWRA

2. Prepare a memorandum summarizing each initial meeting and describing the scope, schedule, recommendations and coordination (if any) that may be required with these non-MWRA projects.

3. Prepare for, attend and prepare minutes of up to eight follow-up coordination meetings.

C. Summary of Issues

1. Review the siting EIR and EIS, MWRA Board votes, court related documents and meet with MWRA staff and staff from regulatory agencies and other significantly affected parties identified by MWRA to identify outstanding issues and to identify those issues that this facilities plan will address.

2. Prepare a draft summary of the outstanding issues and for those issues to be resolved by this facilities plan, identify the work package(s) that will provide a response to each identified issue. The summary will include an approximate schedule of availability for the referenced work package or work products.

3. Seek MWRA comments on the draft summary of outstanding issues and incorporate these comments into a final summary.

4. Prepare a draft summary of those issues to be resolved by

this facilities plan that are expected to require policy level input, identifying the issue, the avenue through which the issue is likely to arise (work package, interim work product, briefings, etc.), the approximate date that an issue summary will be available for review and a schedule for required resolution of the issue.

5. Seek MWRA review of the summary of policy issues to be resolved by this facilities plan and finalize the summary of policy issues.

6. Prepare short summaries of each of the identified issues requiring policy level input.

7. Prepare for, attend and prepare minutes of up to ten presentations, briefings or workshops reviewing outstanding or policy issues.

D. Coordination with Local Technical Representatives

1. Develop and implement procedures that facilitate the flow of information to, and discussions with, the designated technical representatives from those communities most significantly affected by the proposed treatment facilities.

2. Prepare for, attend and prepare minutes of ten presentations, briefings or workshops reviewing technical issues of special concern to the local technical representatives.

III. WORK PACKAGE PRODUCTS

The products of this work package include:

1. Memoranda describing the coordination required by related MWRA projects

2. Memoranda describing the coordination required by non-MWRA projects of significance

3. A summary of outstanding issues and accompanying schedule identifying those issues that this facilities plan is expected to address, and referencing those work packages or work products that are likely to assist in the resolution of such

issues

4. A summary of those outstanding issues, accompanying schedule identifying those issues requiring policy level input, and issues summaries for each identified for policy decisions.

5. Preparation for, attendance and preparation of minutes of up to twenty coordination meetings and twenty presentations or briefings

IV. REQUIRED WORK PACKAGE INPUTS

The required inputs to complete this work package include:

1. WP DB 20A, Previous Studies

2. Board minutes of the siting decision for the new treatment facilities and associated environmental review including the section 61 findings and the record of decision

3. Federal court filings by MWRA and other parties including any court orders

4. MWRA's capital improvement budget and program

5. Scope of services, interim work products, draft and final reports from other MWRA facilities plans, project designs, or other projects underway.

V. RESPONSIBILITY

Coordination memoranda and the summary of issues will be prepared under the direction of the Project Manager, Richard Fox, with the assistance of the Area Managers William Callahan, John Gall, and Jean McCluskey.

Approved: _____
MWRA

_____
CDM/S&W

Date: _____
Rev: 6

WORK SUMMARY: D - DATA COLLECTION

WORK GROUP: FB-20 DATA COLLECTION

WORK PACKAGE: FB-20B INVENTORY AND ON-SITE INSPECTIONS

I. DESCRIPTION OF SCOPE

The scope of this work package is to inventory the current and planned upgraded equipment and processes at the existing Deer Island Plant, including the headworks, and at the existing Nut Island Plant. This inventory will be utilized by other work packages, primarily under FF Unit Process Evaluations, to determine what existing facilities can be incorporated into the secondary treatment facilities. This inventory will assemble the known data including data assembled during previous facilities planning on the process equipment, mechanical, structural and hydraulic conditions, operating and maintenance characteristics, and expected useful life, that is necessary for evaluation of treatment processes and conveyance systems.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include the following:

A. Review existing inventory listings from previous studies to be updated and supplemented by the following tasks.

B. Assemble prints from the existing reproducible plans of the facilities (including as-builts and shop drawings if available) on file with the MWRA's engineering division (presently located at Somerset Street). Collect inventoried prints assembled by consultants for the proposed fast track improvements (if available). Plans of proposed improvements at the facilities will be furnished by the MWRA to CDM/S&W - projects include, as a minimum, the Deer Island Pump and Power Improvements,

Sedimentation Basin Improvements, Winthrop Terminal Improvements, Chlorination Improvements, and Improvements to the Remote Headworks.

C. Those plans will then be supplemented by an examination of bluelines, field records, and operating manuals on file at the facility sites. Notations will be made on the prints of changes found at the site files.

D. The assembled notated plans will then be visually verified by on-site inspections.

Concurrently with the assembling of the available plans, available specifications, operations and maintenance manuals and records, and engineering reports will be catalogued and, where appropriate, copied and placed in the project library.

E. This work package will also include the assembling of a contact list of MWRA operational staff, consultant engineers and service contractors. Persons will be identified by name, assignment and areas of knowledge. The list will be utilized by work packages in work group FF-33 to contact and interview key personnel as needed to evaluate the effectiveness of existing equipment.

III. WORK PACKAGE PRODUCTS

The work package products include:

- Collected data to be provided to the project library established under WP MA-01D
- A memorandum inventorying plans, equipment, key staff and service contractors
- Project plans assembled in project library
- Information disseminated to the project team working on facilities engineering

IV. REQUIRED INPUTS

Required inputs include:

- Systems drawings, specifications, and reports as required
- Existing equipment inventory lists
- Personnel lists

V. RESPONSIBILITY

This work package falls under facilities engineering, which is directed by area manager W.F. Callahan. The work group (FB-20) is directed by S.D. Rafferty, who is also responsible for work package direction and technical products.

Approved: _____
CDM/S&W

_____
MWRA

Date: _____
Revised 6/11/86
Revised 6/20/86
Revised 7/11/86
Revised 7/15/86
Revised 8/1/86
Revised 8/8/86
Revised 12/12/86
Revised 12/23/86
Revised 2/05/87

WORK SUMMARYF - FACILITIES ENGINEERING

WORK GROUP: FB 20 - DATA COLLECTION

WORK PACKAGE: FB 20C - AIR AND WASTEWATER SAMPLING PROGRAM

I. DESCRIPTION OF SCOPE

The scope of this work package is to characterize the wastewater to be treated. Wastewater to the Deer Island facility will initially be treated at one of five separate headworks. The wastewater to each headworks will be characterized, and the characterization of wastewater by headworks will then be utilized for correlation under the flow and load estimation, Task C. The sampling program will provide data for comparison with previous sampling programs. The scope includes a split sample program for correlation with the present MWRA sampling programs at the two existing treatment plants. The wastewater characterization includes determining chemical constituents and their variability, and evaluating the existence of hazardous substances.

This sampling program has been structured in coordination with the wastewater sampling needs of the residuals management facility plan.

The scope of this work package also includes a sampling program to quantify wastewater induced air quality characteristics. Air quality characteristics of concern are those that impact upon the selection of treatment processes. Sampling will be performed on the influent and effluent wastewater to the plants and the headworks, along with air sampling at the remote headwork's tunnel shafts, for use in analytically

quantifying the potential for ozone precursors present at the plant site as well as ozone precursors present at the headworks sites. Characterization of the magnitude of malodorous compounds will also be performed by monitoring H_2S levels at the plants and the remote headworks. The sampling program will be structured to ensure that concurrent influent sampling is conducted over a total of 42 days on a continuous 24 hour composite basis at:

- o Columbus Park (remote headworks)
- o Ward Street (remote headworks)
- o Chelsea Creek (remote headworks)
- o Winthrop Terminal headworks
- o Deer Island plant (downstream of Winthrop terminal)
- o Nut Island treatment plant

Sample analysis will include; BOD5, TSS, Settleable Solids, Chlorides, pH, Total Volatile Solids, Total Solids, Total Nitrogen, Total Phosphorus, Sulfides, Oil and Grease, Priority Pollutant Metals, PCBs and Pesticides, and Semi-Volatile Acids and Base Neutral Extractables.

The type and frequency of analysis of the samples will be as outlined herein and as shown in Attachment C - Sampling Program Schedule.

The 42 day sampling program will be conducted in two separate periods: fall period, from August 27 to September 26, and a spring period. Each period will be selected to correspond to a representative period in the annual cycle of flows as determined by past flow records.

II. TASKS and ACTIVITIES

This work package will include tasks and activities to:

A. Review the following existing data:
Existing data on properties of influent to and effluent from both the Nut Island and Deer Island plants:

- o Monthly plant operating records for the last two years
- o Daily flow logs from the headworks for the last two years
- o MWRA's trend analysis report
- o Other relevant data assembled under Task IC63 and FB 20A

Review the air quality data collected at the Remote Headworks on H_2S

levels and Volatile Organic compounds as part of the ongoing fast track upgrades.

B. Develop a detailed plan for characterization of both the wastewater and air to be treated, and to conduct a sampling and analysis program to collect the data.

- o The influent wastewater characteristics to be identified will consist of those components required for the evaluation of treatment alternatives, outfall siting, and sludge handling and disposal options.

- o The effluent wastewater characteristics to be identified will consist of those components at the headworks and the plants required for use in conjunction with the influent data to quantify the potential for ozone precursors. Effluent characteristics at the plants will also be used in the outfall siting.

- o The air sampling program at the Nut Island and Deer Island facility and the remote headworks will be used to quantify the odor potential associated with the wastewater. Air sampling will also be done at the tunnel shaft at the remote headworks for use in quantifying the potential for ozone precursors at the site.

The sampling program plan will be assembled into a quality assurance/ quality control document (QA/QC) and will be submitted to MWRA and DEQE for review and approval.

C. Prior to the submittal of the QA/QC document, and prior to the initiation of the sampling, a meeting will be held with the DEQE to define both the current and expected applicable requirements pertaining to the sampling program, particularly the air quality requirements associated with the proposed plant operation. Presently, the sampling program is intended to collect data on the existing level of potential ozone precursors, based upon the level of volatile organic compounds present in the wastewater entering and leaving the site (the site being defined as the headworks, Nut Island, and Deer Island).

D. Investigate adequacy of existing flow data signals at each of the sampling locations. Identify to MWRA the power needs and signal wiring to be furnished by them for operation of the flow metered wastewater sampling equipment.

E. Install equipment to collect concurrent, composited wastewater samples. Conduct a test of the installed equipment prior to the

initiation of actual sampling and verify that all equipment is functioning properly.

F. The sampling program will be structured to ensure that concurrent influent sampling is conducted over a total of 42 days on a continuous 24 hour composite basis at:

- o Columbus Park (remote headworks)
- o Ward Street (remote headworks)
- o Chelsea Creek (remote headworks)
- o Winthrop Terminal headworks
- o Deer Island Plant (downstream of Winthrop terminal)
- o Nut Island treatment plant

The type of frequency of analysis of the samples will be as outlined herein and as shown in Attachment C - Sampling Program Schedule.

- o The 42 day sampling program will be conducted in two separate periods. Each period will be selected to correspond to a representative period in the annual cycle of flows as determined by past flow records.

- o During the first sampling period, in addition to influent sampling there will be four days of effluent sample collection from Deer Island and Nut Island and associated analysis. The effluent samples will be collected for use in, and in conjunction with, the Task FG34D (Outfall site selection)

- o During portions of the first sampling period, there will be effluent sampling (as defined in H below) for Volatile Organic Compounds at the Deer and Nut Island plants and at the headworks (except for the Winthrop terminal headworks).

G. The concurrently collected influent samples, as described in F, will be analyzed for conventional parameters as follows:

BOD5	daily
TSS	daily
Settleable Solids	daily
Chlorides	daily
pH (grab samples)	daily except headworks: see chart

- o For three separate days at the headworks and for eleven days thereafter at Deer Island plant influent, and for the entire fourteen days at the Nut Island Plant influent, an oil and grease analysis will be done on grab samples.

- o During the first 14 days of sampling, if there is a clear correlation between the BOD5, TOC, and COD, then the sampling program may substitute TOC and/or COD analysis for the BOD5 analysis for the remainder of the sampling. If the TOC or COD values should appear abnormal then BOD5 will be evaluated on that particular sample.

H. The samples, as described in F, will be analyzed for the 129 Priority pollutants and the Hazardous Substance List (HSL) organic compounds in accordance with Attachment C - Sampling Programs Schedule. For selected samples from both the Acid/Base Neutral and the Volatile Organic Acid fractions of the priority pollutant/HSL, the analysis will include identifying the next twenty compounds that are present in concentrations equal to or greater than twenty-five percent of the nearest internal standard.

- o During the first period the Priority pollutants, Hazardous Substance List and additional peaks will be analyzed for samples from the influents to the headworks and the influent to the Nut Island plant during the first three days. For the next four days of the initial period these analyses will be done on the samples from the influent to the Deer Island and Nut Island plant only. For the second sample period these analyses will be run on the Deer Island and Nut Island influents for five days.

- o For four consecutive days during the first influent sampling period, effluent samples from the plants will also be collected and analyzed for the priority pollutants and the HSL compounds.

- o For 11 additional days during the first sample period and for 5 additional days during the second sample period the samples from the influents to the plants will be analyzed for the Priority pollutant metals plus cyanide, boron and molybdenum.

- o In addition to the three days of concurrent influent sampling at the headworks and at Nut Island of wastewater for Volatile Organics as part of the priority pollutant analysis identified above, concurrent influent wastewater samples will be collected from the headworks sites (except for Winthrop Terminal) for two more days (a total of five sequential days) and the samples will be analyzed for the presence of Volatile Organic Compounds (VOC). For the five days samples will be collected at 6 hour intervals over a 24 hour period for a daily total of 4 samples at each site. For three additional days samples will be collected at each headwork site at a 6 hour interval for a daily total of 2 samples at each site, providing a half day sample.

- o On those five days total when VOC analyses are being collected over 24 hours samples will also be collected and analyzed for the effluent from the remote headworks and the plants. For the three days of half time sampling-effluent samples will be collected at the remote headworks only.

- o For the five day period during which the VOCs are being sampled from the wastewater influent and the effluent of the remote headworks, air samples will be collected from the vent shaft located at the tunnel influent. The collected samples will be analyzed for VOCs in accordance with the EPA's Volatile Organic Sampling Train Protocol. Samples will also be collected and analyzed for total non-methane organic compounds. The flow rate of venting air will also be measured. A total of twenty sample events will be collected at each of the three sites.

I. The following additional parameters will be determined from a daily sample collected at Deer Island downstream of the Winthrop Terminal and from a daily sample collected at Nut Island in accordance with the following schedule:

Chemical Oxygen Demand (COD)	16 days	Composite
Volatile Suspended Solids (VSS)	16 days	Composite
Total Kjeldahl Nitrogen	16 days	Composite
Ammonia Nitrogen	6 days	Composite
Sulfides	6 days	Grab
Total Phosphorus	16 days	Composite
Total Solids	14 days	Composite

J. At both Deer Island and at Nut Island hourly samples will be collected for one weekday and for one weekend day. The hourly samples will be analyzed for the following:

Total Organic Carbon (TOC)
Total Suspended Solids (TSS)

K. Ultimate BODs will be run three times on composited daily samples collected at Deer Island downstream of the Winthrop Headworks and from the Nut Island influent to establish the correlation between BOD5 and ultimate BOD. The samples will include at least one weekend date.

L. For six of the daily samples, including one weekend day, the program will coordinate with the MWRA's existing influent sampling program and will conduct a split sample program for use in correlating the

Facility Plan's influent sampling program and the MWRA's daily sampling program for the following parameters:

BOD5
TSS
Settleable solids
pH
Chlorides
Oil and grease

The split samples will be collected using the plant's existing time composited samples.

M. At Nut Island, and Deer Island downstream of the Winthrop Terminal headworks, the existing information on odors will be collected and evaluated. Hydrogen sulfide (H_2S) has been selected as the indicator compound for evaluation of odor potential. The variability of H_2S levels will be assessed by continuous monitoring at both sites. The monitors will be run for a total of 4 months (two months at each site). At each site the monitors will be operated over a representative period that will encompass a minimum of one summer month (June, July or August). At the remote headworks continuous monitoring will also be done for approximately one month at each site for a total of three months. The influent wastewater to the plants and the headworks will be analyzed for sulfides for four days during the first wastewater sampling period and for two days during the second wastewater sampling period.

N. At the plant site, the impact of NO_x levels will be based upon an evaluation of existing data collected by past site monitoring of NO_x levels, supplemented by data from existing nearby air monitoring stations. No additional NO_x data will be collected.

O. A literature search to evaluate the pathogenic potential of aerosols at the wastewater treatment facilities will be conducted.

P. The collected data will be assembled and a summary memorandum will be prepared and distributed to the appropriate Work Group Leaders.

III. WORK PACKAGE PRODUCTS

1. Program description and QA/QC document

2. Memorandum on results of sampling program

IV. REQUIRED WORK PACKAGE INPUTS

Existing data on wastewater properties and the sampling program from IC 63A, IC 63B and FB20

Draft NPDES parameters for secondary treatment from IC 63B

EPA lists of 129 priority pollutants and the hazardous substance list from IC 63B
Operational records, lab records, and performance records collected under FB 20A, and FB 20B

NPDES permit

EPA Contract Laboratory Program identifying hazardous substance list (HSL)

NIOSH VOC sampling procedure

V. RESPONSIBILITY

This work package falls under facilities engineering which is directed by area manager W. F. Callahan. The work group (FB-20) is directed by S. D. Rafferty, who is also responsible for work package direction and technical products.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 5

WORK SUMMARY: FACILITIES ENGINEERING

WORK GROUP: FC-30 ENGINEERING DESIGN CRITERIA

WORK PACKAGE: FC-30A PROCESS DESIGN CRITERIA

I. DESCRIPTION OF SCOPE

The scope of this work package is to develop preliminary and final process design criteria for the screening and detailed evaluation of treatment alternatives. Work within this package develops general design criteria for those elements common to the overall MWRA treatment facilities including headworks facilities and the Deer Island plant; preliminary unit process design criteria applicable to the initial screening of potential unit processes; and specific in-depth unit process design criteria applicable to the detailed evaluation of short listed unit processes. The general design criteria and the specific in-depth unit process design criteria will be reviewed by the MWRA Staff, Review Consultants, and the regulatory agencies.

The scope of this work package is divided into six major subareas as follows:

A. Develop General Design Criteria. The purpose of this task is to develop general design criteria common to all unit processes and applicable to the overall layout and operation of the treatment facilities. Items to be included are development of design flood elevations against which the plant must be protected and against which the plant must be fully operable, definition of those facilities which are deemed essential and will require emergency or back-up power, development of redundancy requirements, determination of the mode of inter-process liquid conveyance and the method of flow distribution to main treatment units, in-plant water requirements in terms of protected water and plant effluent, and development of general requirements for unit by-passing and dewatering. Design

criteria used for selected large facilities in the United States will be reviewed and MWRA mitigation commitments incorporated into the general design criteria. RMFP needs will be incorporated as necessary.

B. Develop Preliminary Unit Process Design Criteria for Initial Screening of Unit Process Alternatives. The purpose of this task is to develop unit process design criteria applicable to the screening of alternatives. Design criteria will be limited to that necessary to establish approximate unit sizing and areal requirements and reflect the general intent of known mitigation commitments. Design criteria will be used for evaluation of potential unit processes (FF-33A through E) and screening of alternative unit processes (FJ-36A). Criteria will be developed for five major process areas:

    1. Preliminary treatment and headworks
    2. Primary treatment and residuals collection
    3. Secondary treatment and residuals collection
    4. Disinfection
    5. Emissions control

C. Refine General Design Criteria. The purpose of this task is to finalize the general design criteria developed under Task A. Review comments from the MWRA Staff, Review Consultants, and the regulatory agencies will be incorporated into final criteria. Criteria will be used in the development and evaluation of alternative treatment trains (FJ-36A). Approval to proceed with Subtask D will be obtained from the Massachusetts Division of Water Pollution Control.

D. Develop Final Unit Process Design Criteria for Detailed Evaluation. The purpose of this task is to develop in-depth design criteria for unit processes short listed under screening of alternative unit processes (Work Package FJ-36A). Unit loadings and process performance at other large facilities will be reviewed. Mitigation commitments will be incorporated. Detailed design criteria will be developed for the five major process areas defined in Task B. Areas where the proposed design criteria differ from commonly accepted standards will be delineated. Proposed design criteria will be described in memorandum form. Criteria will be used in the evaluation of detailed unit process alternatives (FF-33A through E).

E. Review Unit Process Criteria with Regulatory Agencies. The purpose of this task is to review the design criteria developed in Task D with the MWRA Staff, Review Consultants, and the regulatory agencies. Review comments will be incorporated into final unit process design criteria.

F. Prepare Interim Report. The purpose of this task is documentation of the work produced. Sections dealing with design criteria will be produced for inclusion in the interim report summarizing the screening of alternative process trains (Work Package FJ-36A). Separate sections shall be prepared for:

1. General design criteria
2. Specific unit process design criteria grouped according to the five major areas identified in Task B

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Develop General Design Criteria

1. Review published design guidelines
2. Review design criteria for existing facilities
3. Review MWRA mitigation commitments
4. Coordinate with RMFP Facilities Planning
5. Review design criteria at selected large treatment plants in the United States (100 mgd or larger)
6. Develop design criteria for flood protection
    a. max. flood level for complete plant operation
    b. design flood level for prevention of structural and equipment damage
7. Define essential facilities which will require emergency or back-up power
8. Determine equipment and tankage redundancy requirements
9. Determine general method of flow distribution to main treatment units
    a. positive means entailing deliberate imposition of headloss to minimize effects of flow variations
    b. hydraulically similar inlet piping or channels
10. Determine preferred method of interprocess conveyance (open channel vs. piping). This will include the use and extent of operating galleries interconnecting various plant components.
11. Identify general protected and plant water requirements. Include flushing, foam control, lawn sprinkling, fire protection, and general plant use (personnel and process). Estimate the required volume of protected water.
12. Develop general requirements for unit bypassing and unit dewatering
13. Prepare memorandum presenting proposed general design criteria

B. Develop Preliminary Unit Process Design Criteria for Initial Screening of Alternative Unit Processes

1. Prepare unit process criteria for screening of alternative unit processes. Criteria will be limited to that required to establish approximate unit sizing and areal requirements.
   a. preliminary treatment and headworks
   b. primary treatment and residuals collection
   c. secondary treatment and residuals collection
   d. disinfection
   e. emissions control

C. Refine General Design Criteria

1. Incorporate review comments into general design criteria formulated in Task A
2. Develop final general design criteria defining:
   a. flood protection
   b. essential facilities with regard to power
   c. equipment and tankage redundancy
   d. general methodology of flow distribution
   e. method of interprocess conveyance
   f. protected and plant (effluent) water uses
   g. requirements for unit bypassing and dewatering

3. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask D.

D. Develop Final (In-Depth) Unit Process Design Criteria for Detailed Evaluation of Alternative Unit Processes

1. Review published guidelines
2. Review unit loadings and process performance at other large facilities
3. Review MWRA mitigation commitments
4. Develop detailed unit process design criteria for all alternatives considered for the detailed evaluation for:
   a. preliminary treatment and headworks
   b. primary treatment and residuals collection
   c. secondary treatment and residuals collection
   d. disinfection
   e. emissions control

5. Identify design criteria which vary from commonly accepted standards
6. Prepare memorandum presenting detailed unit process design criteria

E. Review Final Unit Process Design Criteria with Regulatory Agencies

1. Review unit process design criteria with MWRA Staff and Review Consultants
2. Review unit process design criteria with state and federal regulatory agencies
3. Incorporate review comments into design criteria

F. Prepare Interim Report

1. Prepare chapters on design criteria for inclusion in the interim report prepared under Work Package FJ-36A summarizing the screening of alternative unit processes. Separate chapters shall be prepared for:
   a. general design criteria
   b. specific unit process design criteria
      1. preliminary treatment and headworks
      2. primary treatment and residuals collection
      3. secondary treatment and residuals collection
      4. disinfection
      5. emissions control

III. WORK PACKAGE PRODUCTS

The work package products include:

1. Memorandum on general design criteria
2. Memorandum on final (in-depth) unit process design criteria
3. Sections for Interim Report (Work Package FJ-36A)

IV. REQUIRED WORK INPUTS

Inputs required to complete this work package include:

1. Flows and Loads (IC-63A)
2. Performance/Removal Criteria (IC-63B)
3. Identify and Evaluate Treatment Alternatives; list of alternative unit processes
4. Reliability/Flexibility Analysis (FJ-36B)
5. RMFP Facility Needs

V. RESPONSIBILITY

This work package falls under facilities engineering which is directed by area manager W.F. Callahan. The work group (FC-30) is directed by A.C. Firmin who is also responsible for work package direction and

technical products. Professor David Jenkins will review process design criteria as it progresses.

Approved: _____
MWRA

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CDM/S&W
Date: _____
Rev: 7

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FD-31 DEER ISLAND CONCEPTUAL LAYOUT

WORK PACKAGE: FD-31A HARBOR PERSPECTIVE (ALTERNATIVE CONCEPTS)

I. DESCRIPTION OF SCOPE

The scope of this work is to develop initial alternative macroscale planning and architectural concepts for Deer Island and ancillary facilities at Nut Island which will address major planning issues and be compatible and within the context of the abutting communities and other waterfront developments around Boston Harbor.

The issues to be addressed include:

1. Historic preservation, open space and multiple use opportunities including recreational uses
2. Site safety and security for new facilities
3. MWRA mitigation commitments

Included in this work package will be a review and analysis of the impacts associated with the Site Options EIR and EIS; a review of the MWRA mitigation program; and review of alternative land use ideas and progress drawings with the MWRA and local technical representatives, including additions and revisions based on this review. Other aspects of this work package are the development of public and staff presentations and the preparation of technical memoranda.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Review project data concerning major impact categories of the Site Options EIR and EIS.

1. Social (adverse community impacts)
2. Technical (engineering and scientific)
3. Environmental (natural and built environment, historical and archaelogical)
4. Economic (costs and financial effects)
5. Political (jurisdictional implications)
6. Legal (judicial concerns)
7. Institutional (planning coordination)

B. Review Mitigation Program

C. Review planning for Boston Harbor Islands comprehensive plan and water front development around Boston Harbor.

D. Coordinate existing conditions analysis and multiple use opportunities plan prepared for Nut Island in FE-32A.

E. Develop a visual analysis of Deer Island and Nut Island within the context of Boston Harbor as perceived from following vantage points:

1. Abutting communities
2. Neighboring islands
3. Recreational boating and boating channels

F. Coordinate alternative engineering process schematic flow diagrams and design studies in light of site constraints and planning objectives. Coordinate with and evaluate conceptual "foot print" as provided from WP FD-31B and FE-32A.

G. Utilizing the above information, identify and develop major land use ideas and related site/architectural images compatible with abutting communities and other waterfront developments.

1. Investigate alternatives minimizing the visual impact of the plant.
2. Investigate alternatives making the new plant a prominent feature of harbor.

H. Review alternative land use ideas and progress drawings with the MWRA and local technical representatives and make additions and revisions based on this review.

I. Develop presentations

1. Develop drawings of selected alternative concept plans which illustrate to the public, public improvements focusing on mitigation commitments.

2. Develop artists' renderings of selected alternative concepts.

3. Develop three dimensional computer aided design conceptual model of Deer Island and Nut Island within context of Boston Harbor.

J. Prepare technical memorandum

1. Discuss planning constraints and objectives
2. Discuss advantages/disadvantages of alternative concepts
3. Present technical memorandum to the public through WP IL60A.

III. WORK PACKAGE PRODUCTS

The products from this work package are intended for presentation to the public and to governmental agencies, and include:

A. A Technical Memorandum describing the ideas and images of alternative planning and architectural concepts for the project.

B. Drawings

1. Plan of Boston Harbor showing zones of waterfront usage (recreational, residential, commercial, industrial).
2. Alternative concept plans for Deer Island (Scale : 1" = 200') and Nut Island (Scale: 1" = 200') (Limited to four alternatives for Deer Island, two for Nut Island.)
3. Sketches of alternatives and alternative perspective views
4. Illustrative sections or elevations rendered

C. A three-dimensional computer aided design conceptual model (graphic image only) of Deer Island and Nut Island within context of Boston Harbor

D. Three sets of slides and three copies of videotape. Two sets of all plans, renderings, and other illustrations for the MWRA, 2 sets for the Engineer, and one set each for Quincy and Winthrop.

IV. WORK PACKAGE INPUTS

Inputs required by this work package include:

1. Data on seven major impact categories of E.I.S. and related reports prepared for all governmental authorities

2. Geotechnical and geo-morphological reports on Deer Island and Nut Island

3. Topographical surveys of Deer Island and Nut Island

4. Aerial photographs of Deer Island and Nut Island

5. Historical report and recommendation

6. Archeological report

7. Boston Harbor Islands comprehensive plan

8. Conceptual "footprint" and sequencing of building and treatment (FD-31B and FE-32A).

V. RESPONSIBILITY

This work package falls under facilities engineering which is directed by area manager W.F. Callahan. The work group (FD-31) is directed by S.D. Rafferty. Mr. R.E. Cary of Jung/Brannen Associates, Inc. is responsible for work package direction and products.

Approved:

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MWRA

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CDM/S&W

Date: _____
Rev: 6

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FD-31 DEER ISLAND CONCEPTUAL LAYOUT

WORK PACKAGE: FD-31B DEER ISLAND SITE PLANNING

I. DESCRIPTION OF SCOPE

The scope of this work package will consist of a two phase approach consisting of a conceptual planning phase leading into a detailed site planning phase. In the conceptual phase, existing information will be reviewed, and future process requirements will be identified, screened and presented to the public. Process area requirements or "footprints" will be developed for input to the Harbor Perspective Work Package (FD-31A) for public presentation. Under the Harbor Perspective Work Package, alternative concept plans for land use will be developed. These alternative concept plans will be used as input to the detailed site planning phase of this work package. Under the detailed phase, alternative site plans will be developed incorporating alternative treatment process trains. From these alternatives a recommended detailed site plan will be selected. Architectural concepts will be developed for the alternative and recommended plans.

Throughout the planning for this work package the following issues will be adddressed:

- o Historic preservation, open space and multiple use opportunities
- o Site safety and security for existing and new facilities (FO-38B)
- o MWRA mitigation commitments (EI-50D)
- o Maintaining existing operation during construction (FS-40A)
- o Ongoing coordination with the public and incorporation of comments

The scope is divided into five major tasks. Tasks A and B make up the conceptual phase and Tasks C, D, and E, the detailed phase.

A. Review Existing Information. The purpose of this task is to review information from previous studies, on-island pier study, designs, ongoing construction, as-built drawings, and other site related information, and document the findings.

B. Identification of Alternative Area Requirements. The purpose of this task is to identify future process requirements. Alternative area requirements and sequencing of processes will be identified for use in the Harbor Perspective Work Package (FD-31A). Coordinate with RMFP consultant regarding residual processes area requirements.

C. Develop Detailed Alternative Site Plans. This task will develop detailed alternative site plans from the Alternative Conceptual Site Plans generated in Work Package FD-31A. The site plans will include the layout of alternative process trains developed in Work Package FJ-36A. The process train layouts will show tank geometry and unit process sequence. These alternative process trains and site layouts will consider a "battery treatment scheme" which will allow North/South system flowpaths. Detailed site development concepts for buildings, structures and grounds will be developed. This task will also coordinate residuals management alternatives identified in the RMFP with the treatment process trains and site layouts developed in this work package.

D. Develop Recommended Site Plan. Under this task the recommended detailed site layout from Task C will be developed into a recommended site plan. The recommended site plan will include site development concepts for buildings, structures, treatment facilities, and other site uses.

E. Prepare Technical Memorandum. The purpose of this task is to prepare a technical memorandum documenting the work produced in Tasks C and D.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Review Existing Information

1. Review information from existing studies, designs ongoing construction, as-built drawings, and other site related information, and obtain subsurface data from Work Group 35.

2. Review environmental baseline conditions such as sensitive receptors, sensitive populations, and environmentally sensitive areas.

3. Review master plans, development plans and other applicable plans approved by the City of Winthrop.

B. Identification of Alternative Area Requirements

1. Obtain preliminary process requirements for the future treatment facility using input from Work Package FJ-36A.

2. Obtain transition plans for preliminary process trains that maintain operation of the existing treatment facilities during construction.

3. Identify preliminary area requirements ("footprint") and sequencing of buildings and treatment processes. These requirements are necessary input to the Harbor Perspective Work Package (FD-31A).

4. Coordinate with RMFP consultants regarding residual processes' preliminary area requirements.

C. Develop Detailed Alternative Site Plans

1. Develop detailed alternative site plans from the four alternative concept plans generated by the Harbor Perspective Work Package (FD-31A). These site plans will be input to Work Packge FJ-36A for selection of the recommended plan.

2. Develop layouts for the alternative process trains identified in Work Package FJ-36. These layouts, showing tank geometry and the unit process sequence, will consider a "battery treatment scheme" that will allow North/South System flowpaths.

3. Coordinate residuals management alternatives identified in the RMFP.

4. Develop site development concepts for buildings, structures and grounds.

5. Review alternative site plans with MWRA.

6. Develop preliminary capital cost estimates.

D. Develop Recommended Site Plan

1. Develop the recommended detailed site layout of the future treatment processes.

2. Determine the detailed site development concepts for the recommended buildings, structures, and grounds.

3. Review items 1 and 2 with MWRA.

4. Develop recommended site plan incorporating items 1 and 2.

E. Prepare Technical Memorandum

1. Prepare technical memorandum that contains:

   a. The recommended plan
   b. Site planning challenges
   c. Incorporation of public and agency comments
   d. Documentation of selection methodology
   e. Capital and operations and maintenance costs

III. WORK PACKAGE PRODUCTS

1. Existing conditions analysis
2. Alternatisite plans (Scale 1" = 200')
3. Recommended site plan (Scale 1" = 200')
4. Models of alternative site plans (Scale 1" = 200')
   (Limited to four alternatives)
5. Model of recommended site plan (Scale 1" = 200)
6. Rendered and colored perspective view of recommended site plan
7. Technical memorandum

IV. WORK PACKAGE INPUTS

1. Existing studies, designs, drawings and other site-related information
2. Environmental baseline information (EI-50A)
3. Alternative planning and architectural concepts (FD-31A)

4. Transport system evaluation (Work Group 34)
5. Estimated flows and loads (Work Group 63)
6. Topographic and geotechnical information (FH-35A)
7. Maintenance of plant operations (FS-40A)
8. Screened unit process layout (FJ-36A)
9. Detailed unit process layout (FJ-36A)
10. Residuals management alternatives from RMFP
11. Public comments

V. RESPONSIBILITY

This work package falls under facilities engineering, which is directed by area manager W. F. Callahan. The work group is directed by S. D. Rafferty, who is also responsible for work package direction and products.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 7

SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FE-32 NUT ISLAND CONCEPTUAL LAYOUT

WORK PACKAGE: FE-32A NUT ISLAND SITE PLANNING

I. DESCRIPTION OF SCOPE

The scope of this work package includes the identification and evaluation of alternative concepts for site arrangements for Nut Island facilities, and preparation of a detailed conceptual site plan.

Throughout the planning for this work package the following issues will be addressed:

- o open space and multiple use opportunities
- o site safety and security for existing and new facilities (FO-38B)
- o MWRA mitigation commitments (EI-50D)
- o maintaining existing operation during construction (FS-40A)
- o ongoing coordination with the public and incorporation of comments

The scope is divided into six major subareas as follows:

A. Review Existing Information. The purpose of this task is to review information from previous studies, designs, ongoing construction, as-built drawings, subsurface data from Work Package FH-35A and other site related information, and document the findings.

B. Assess Treatment Operations Requirements. This task will evaluate the present and future operational requirements of the Nut Island treatment facility during construction of proposed facilities and decommissioning of remaining plant and its impact on facility layout.

C. Identification and Screening of Future Process/Area Requirements. The purpose of this task is to identify and screen future process/area requirements and associated decommissioning staging of existing facilities.

D. Detailed Evaluation of Alternative Site Plans. This task will evaluate in detail the alternative process requirements and decommissioning programs from Task C utilizing the Alternative Conceptual Site Plans from FD-31A. Approval to proceed with Subtask E will be obtained from the Massachusetts Division of Water Pollution Control.

E. Selection of Recommended Site Plan. Under this task the recommended headworks processes and layout will be chosen and incorporated into a recommended site plan.

F. Prepare Technical Memorandum. The purpose of this task is to prepare a technical memorandum documenting the selection of the recommended site plan.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Review Existing Information

1. Review information from existing studies, designs, ongoing construction, as built drawings, subsurface data from Work Package FH-35A and other site related information.

2. Review environmental baseline conditions.

3. Review master plans, development plans and other applicable plans approved by the City of Quincy.

4. Develop an existing conditions analysis map.

5. Develop multiple use opportunities plan.

B. Assess Treatment Operations Requirements

1. Identify facilities at the treatment plant necessary for operation through the remaining life of the existing treatment plant.

2. Define decommissioning staging options for the existing facilities.

C. Identification and Screening of Future Process Requirements

1. Obtain preliminary process requirements for the future facilities (FF-33A).

2. Develop transition plans for preliminary process schemes that maintain operation of the treatment facilities during construction.

3. Identify preliminary headworks area requirements. These requirements are necessary input to the Harbor Perspective Work Package (FD-31A).

D. Detailed Evaluation of Alternative Site Plans

1. Develop detailed site plans from the two alternative concept plans generated by the Harbor Perspective Work Package (FD-31A).

2. Evaluate in detail the future processes and site layouts for the future headworks alternatives.

3. Review alternative site plans with MWRA.

4. Develop preliminary capital cost estimates.

5. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask E.

E. Development of Recommended Site Plan

1. Develop layout of the future headworks facilities.

2. Review Item 1 with MWRA.

3. Develop recommended site plan.

F. Prepare Technical Memorandum

Prepare a technical memorandum that contains:

1. The recommended plan
2. Site planning challenges
3. Incorporation of public and agency comments

4. Documentation of selection methodology
5. Capital costs

III. WORK PACKAGE PRODUCTS

1. Existing conditions analysis
2. Multiple use opportunities plan
3. Alternative site plans (Scale 1" = 40')
4. Recommended site plan (Scale 1" = 40')
5. Models of alternative site plan (Scale 1" = 200')(Limited to two alternatives)
6. Model of recommended site plan (Scale 1" = 200')
7. Rendered and colored perspective view of recommended site plan
8. Technical memorandum

IV. WORK PACKAGE INPUTS

1. Existing studies, designs, drawings and other site-related information
2. Environmental baseline information (EI-50A)
3. Alternative planning and architectural concepts (FD-31A)
4. Inter-island transport system evaluation (Work Group 34)
5. Topographic and geotechnical information (FH-35A)
6. Maintenance of plant operations (FS-40A)
7. Screened unit processes (FF-33A)
8. Detailed unit process alternatives (FF-33A)
9. Cost-effectiveness analysis criteria (FM-37B)
10. Existing Plant Operations (FS-40A)
11. Flow and Load Estimates (IC-63A)
12. Public Comments

V. RESPONSIBILITY

This work package falls under facilities engineering which is directed by area manager W.F. Callahan. The work group (FE-32) is directed by J.F. Donovan. Mr. B.G. Braley is responsible for work package direction and products.

Approved: _____
MWRA

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CDM/S&W
Date: _____
Rev: 6

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FF-33 UNIT PROCESS EVALUATIONS

WORK PACKAGE: FF-33A PRELIMINARY TREATMENT AND HEADWORKS

I. DESCRIPTION OF SCOPE

The scope of this work package is to assess the adequacy of existing preliminary treatment facilities and to evaluate unit processes for screening and grit removal at the following headworks: Columbus Park, Chelsea Creek, Winthrop Terminal, Ward Street, and Nut Island. Unit process evaluation will be performed in two phases: evaluation of potential unit processes for preliminary treatment and evaluation of short listed preliminary treatment processes considered within the detailed alternatives analysis.

The scope of this work package is as follows:

A. Evaluate Existing and Proposed Facilities. The purpose of this task is to evaluate the existing and proposed screening and grit removal facilities in order to determine which components may be considered for incorporation into the overall proposed treatment scheme. Historical data and previous/ongoing studies and designs will be reviewed. Key treatment staff will be interviewed. Existing and proposed facilities to be considered for retention or incorporation into the final treatment scheme will be identified.

B. Evaluate Potential Unit Processes. The purpose of this task is to evaluate each of the potential preliminary treatment processes identified in Work Package FJ-36A as to its general viability. Approximate area requirements will be determined based on preliminary design criteria developed under FC-30A. Each process will be evaluated with respect to relative costs

and other preliminary evaluation criteria developed under (FJ-36A). Previous use of the process at other facilities will be identified including the size of existing installations, number of years of use, and general performance. Findings will be reviewed with the MWRA staff, technical consultants and the regulatory agencies, and presented in a technical memorandum. Approval to proceed with Subtask C will be obtained from the Massachusetts Division of Water Pollution Control.

C. Evaluation of Detailed Unit Process Alternatives. The purpose of this task is to conduct detailed evaluations of those preliminary treatment processes short listed under FJ-36A, Screening of Potential Unit Processes. Layouts of other selected large facilities will be reviewed for applicability.

The unit processes and related facilities will be sized, flow schedules developed, and preliminary layouts prepared. The amount and characteristics of screenings and grit will be estimated and the mode of removal determined.

Capital and operating costs will be estimated. Staffing, power, fuel and chemical requirements will be estimated. Products from this work package will be continuously reviewed with the MWRA staff, technical consultants, and the regulatory agencies. Results of this work package will be presented in a technical memorandum.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Evaluate Existing and Proposed Facilities

1. Review historical data and previous/ongoing studies and designs
2. Interview key treatment plant staff
3. Identify existing and proposed facilities to be considered for retention or incorporation into overall treatment scheme

B. Evaluate Potential Unit Processes. For each of the alternative preliminary treatment unit processes identified in Work Package FJ-36A:

1. Using preliminary design criteria, develop approximate area requirements

2. Determine previous experience of the process
    a. Number of installations
    b. Largest size (unit and total plt. flow)
    c. Number of years operating
    d. General performance
3. Evaluate with respect to relative capital costs, operating costs, and other preliminary evaluation criteria
4. Review findings with MWRA staff, technical consultants, and the regulatory agencies
5. Present results in technical memorandum
6 Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask C.

C. Evaluation of Detailed Unit Process Alternatives. For each of the preliminary treatment alternatives short listed in Work Package FJ-36A and using Final Design Criteria developed under FC-30A:

1. Coordinate with residual solids consultant
2. Review structural, hydraulic, and mechanical layouts
3. Size unit processes and related facilities
4. Determine mode and frequency of screenings and grit removal
5. Prepare flow schematic
6. Prepare preliminary layouts
7. Estimate average and peak month quantities of screenings and grit
8. Estimate staffing, power, fuel, and chemical requirements
9. Prepare capital cost estimate
10. Prepare annual operating cost estimate
11. Conduct ongoing review with MWRA staff, technical consultants, and the regulatory agencies
12. Present results in technical memorandum

III. WORK PACKAGE PRODUCTS

The work package products include:

1. Memorandum on evaluation of potential unit processes
2. Memorandum on detailed process evaluation

IV. REQUIRED WORK INPUTS

Inputs required to complete this work package include:

1. List of unit processes for evaluation (FJ-36A)
2. Preliminary design criteria (FC-30A) and preliminary evaluation criteria (FJ-36A)
3. Coordination with residual solids consultant
4. Cost-effectiveness analysis criteria (FM-37B)
5. Unit process alternatives for detailed evaluation (FJ-36A)
6. General design criteria and final unit process design criteria (FC-30A)
7. Flows and loads (IC-63A)
8. On-site inspection (FB-20B)

V. RESPONSIBILITY

This work package falls under facilities engineering which is directed by W.F. Callahan. The work group (FF-33) is directed by A. C. Firmin. B. Braley is responsible for work package direction and products.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 8

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FF-33 UNIT PROCESS EVALUATIONS

WORK PACKAGE: FF-33B PRIMARY TREATMENT AND RESIDUAL COLLECTION

I. DESCRIPTION OF SCOPE

The scope of this work package is to evaluate unit processes for primary treatment and residual collection. Evaluation of the existing and proposed primary treatment facilities will also be conducted as part of this task. Unit process evaluation will be performed in two phases: evaluation of potential unit processes for primary treatment and evaluation of short listed primary treatment processes considered within the detailed alternatives analysis.

The scope of this work package is as follows:

A. Evaluate Existing and Proposed Facilities. The purpose of this task is to evaluate the existing and proposed primary treatment facilities. Historical data and previous/ongoing studies and designs will be reviewed. Key treatment staff will be interviewed. Existing facilities to be considered for retention or incorporation into the new plant will be identified.

B. Evaluate Potential Unit Processes. The purpose of this task is to evaluate each of the potential primary treatment processes identified in Work Package FJ-36A as to its general viability at Deer Island. Approximate area requirements will be determined based on preliminary design criteria developed under FC-30A. Each process will be evaluated with respect to relative costs and other preliminary evaluation criteria developed under (FJ-36A). Previous use of the process at other facilities will be identified including the size of existing installations,

number of years of use, and general performance. Findings will be reviewed with the MWRA staff, technical consultants and the regulatory agencies, and presented in a technical memorandum. Approval to proceed with Subtask C will be obtained from the Massachusetts Division of Water Pollution Control.

C. Evaluation of Detailed Unit Process Alternatives. The purpose of this task is to conduct detailed evaluations of those primary treatment processes short listed under FJ-36A, Screening of Potential Unit Processes. Layouts of other selected large facilities will be reviewed for applicability at Deer Island. The unit processes and related facilities will be sized, flow schedules developed, and preliminary layouts prepared. The amount and characteristics of sludge and scum will be estimated and the mode of removal from the primary process determined. Capital and operating costs will be estimated. Staffing, power, fuel and chemical requirements will be estimated. An assessment will be made as to whether pilot testing would be required to confirm design parameters if the process were to be selected as part of the recommended plan. Products from this work package will be continuously reviewed with the MWRA staff, technical consultants, and the regulatory agencies. Results of this work package will be presented in a technical memorandum.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Evaluate Existing and Proposed Facilities

1. Review historical data and previous/on-going studies and designs
2. Interview key treatment plant staff
3. Identify existing facilities to be considered for retention or incorporation into the new Deer Island plant

B. Evaluate Potential Unit Processes. For each of the alternative primary treatment and residual collection unit processes identified in Work Package FJ-36A:

1. Using preliminary design criteria, develop approximate area requirements
2. Determine previous experience of the process
    a. Number of installations
    b. Largest size (unit and total plt. flow)
    c. Number of years operating
    d. General performance

3. Evaluate with respect to relative capital costs, operating costs, and other preliminary evaluation criteria
4. Review findings with MWRA staff, technical consultants, and the regulatory agencies
5. Present results in technical memorandum
6. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask C.

C. Evaluation of Detailed Unit Process Alternatives. For each of the primary treatment and residual collection alternatives short listed in Work Package FJ-36A, and using Final Design Criteria developed under FC-30A:

1. Coordinate with residual solids consultant regarding sidestreams and sludge production
2. Review structural, hydraulic, and mechanical layouts of other selected large facilities
3. Size unit processes and related facilities
4. Determine mode and frequency of sludge wasting and scum removal
5. Prepare flow schematic
6. Prepare preliminary layouts
7. Estimate average and peak month quantities of sludge and scum
8. Characterize sludge and scum as to dry solids content, volatile content, and heavy metals
9. Estimate staffing, power, fuel, and chemical requirements
10. Prepare capital cost estimate
11. Prepare annual operating cost estimate
12. Address need for pilot studies
13. Conduct on-going review with MWRA staff, technical consultants, and the regulatory agencies
14. Present results in technical memorandum

III. WORK PACKAGE PRODUCTS

The work package products include:

1. Memorandum on evaluation of potential unit processes
2. Memorandum on detailed process evaluation

IV. REQUIRED WORK INPUTS

Inputs required to complete this work package include:

1. List of unit processes for evaluation (FJ-36A)

2. Preliminary design criteria (FC-30A) and preliminary evaluation criteria (FJ-36A)
3. Coordination with residual solids consultant
4. Cost-effectiveness analysis criteria (FM-37B)
5. Unit process alternatives for detailed evaluation (FJ-36A)
6. General design criteria and final unit process design criteria (FC-30A)
7. Flows and loads (IC-63A)
8. On-site Inspection (FB-20B)

V. RESPONSIBILITY

This work package falls under facilities engineering which is directed by area manager W.F. Callahan. The work group (FF-33) is directed by A.C. Firmin. J.F. Donovan is responsible for work package direction and products.

Approved: _____
MWRA

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CDM/S&W

Date: _____

Rev: 8

WORK SUMMARY: FACILITIES ENGINEERING

WORK GROUP: FF-33 UNIT PROCESS EVALUATIONS

WORK PACKAGE: FF-33C, FF-33D SECONDARY TREATMENT AND RESIDUAL COLLECTION

I. DESCRIPTION OF SCOPE

The scope of this work package is to evaluate unit processes for secondary treatment and residual collection. The evaluations will be performed in two phases: evaluation of potential unit processes for secondary treatment and evaluation of short listed secondary treatment processes considered within the detailed alternatives analysis.

The scope of this work package is as follows:

A. Evaluate Potential Unit Processes. The purpose of this task is to evaluate each of the potential secondary treatment processes identified in Work Package FJ-36A as to its general viability at Deer Island. Approximate areal requirements will be determined based on preliminary design criteria developed under FC-30A. Each process will be evaluated with respect to relative costs and other preliminary evaluation criteria developed under (FJ-36A). Previous use of the process at other facilities will be identified including the size of existing installations, number of years of use, and general performance. Findings will be reviewed with the MWRA staff, technical consultants, and regulatory agencies and presented in a technical memorandum. Approval to proceed with Subtask B will be obtained from the Massachusetts Division of Water Pollution Control.

B. Evaluation of Detailed Unit Process Alternatives. The purpose of this task is to conduct detailed evaluations of those secondary treatment processes short listed under FJ-36A, Screening of Potential Unit Processes. Layouts of other selected large facilities will be reviewed for applicability at

Deer Island. The unit processes and related facilities will be sized, flow schedules developed, and preliminary layouts prepared. The amount and characteristics of sludge and scum will be estimated and the mode of removal from the secondary process determined. Capital and operating costs will be estimated. Staffing, power, fuel and chemical requirements will be estimated. An assessment will be made as to whether pilot testing would be required to confirm design parameters if the process were to be selected as part of the recommended plan. Products from this work package will be continuously reviewed with the MWRA staff, technical consultants, and regulatory agencies. Results of this work package will be presented in a technical memorandum.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Evaluate Potential Unit Processes. For each of the alternative secondary treatment and residual collection unit processes identified in the first phase of Work Package FJ-36A:

1. Using preliminary design criteria, develop approximate area requirements
2. Determine previous experience of the process
    a. Number of installations
    b. Largest size (unit and total plt. flow)
    c. Number of years operating
    d. General performance
3. Evaluate with respect to relative capital costs, operating costs, and other preliminary evaluation criteria
4. Review findings with MWRA staff, technical consultants, and regulatory agencies
5. Present results in technical memorandum
6. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask B.

B. Evaluation of Detailed Unit Process Alternatives. For each of the secondary treatment and residual collection alternatives short listed in Work Package FJ-36A and using Final Design Criteria developed under FC-30A:

1. Coordinate with residual solids consultant regarding sidestreams and sludge production
2. Review structural, hydraulic, and mechanical layouts of other selected large facilities

3. Size unit processes and related facilities. Include evaluation of rectangular vs circular final clarifiers.
4. Determine mode and frequency of sludge wasting and scum removal
5. Prepare flow schematic
6. Prepare preliminary layouts
7. Estimate average and peak month quantities of sludge and scum
8. Characterize sludge and scum as to dry solids content, volatile content, and heavy metals
9. Estimate staffing, power, fuel, and chemical requirements
10. Prepare capital cost estimate
11. Prepare annual operating cost estimate
12. Address need for pilot studies
13. Conduct on-going review with MWRA staff, technical consultants, and regulatory agencies
14. Present results in technical memorandum

III. WORK PACKAGE PRODUCTS

The work package products include:

1. Memorandum on evaluation of potential unit processes
2. Memorandum on detailed process evaluation

IV. REQUIRED WORK INPUTS

Inputs required to complete this work package include:

1. List of unit processes for evaluation (FJ-36A)
2. Preliminary design criteria (FC-30A) and preliminary evaluation criteria (FJ-36A)
3. Coordination with residual solids consultant
4. Cost-effectiveness analysis criteria (FM-37B)
5. Unit process alternatives for detailed evaluation (FJ-36A)
6. General design criteria and final unit process design criteria (FC-30A)
7. Flows and loads (IC-63A)

V. RESPONSIBILITY

This work package falls under facilities engineering which is directed by area manager W.F. Callahan. The work group (FF-33) is directed by A.C. Firmin. J.F. Donovan is responsible for work package direction and products.

Approved: _____
MWRA

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CDM/S&W
Date: _____
Rev: 6

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FF-33 UNIT PROCESS EVALUATIONS

WORK PACKAGE: FF- 33E DISINFECTION

I. DESCRIPTION OF SCOPE

The scope of this work package is to evaluate unit processes for disinfection. Unit process evaluation will be conducted in two phases: evaluation of potential unit processes for disinfection and evaluation of short listed disinfection processes considered within the detailed alternatives analysis. Evaluation of the existing disinfection facilities will also be conducted as part of this work package.

The scope of this work package is as follows:

A. Evaluate Existing Facilities. The purpose of this task is to evaluate the existing disinfection facilities. Historical data and previous/on-going studies and designs will be reviewed. MWRA mitigation commitments will be carefully reviewed and incorporated. Key treatment staff will be interviewed. Existing facilities to be considered for retention or incorporation into the new plant will be identified.

B. Evaluate Potential Unit Processes. The purpose of this task is to evaluate each of the potential disinfection processes identified in Work Package FJ-36A as to its general viability at Deer Island. Approximate areal requirements will be determined based on preliminary design criteria developed under FC-30A. Each process will be evaluated with respect to relative costs, water quality criteria (FG-34D) and other evaluation criteria developed under (FJ-36A). Previous use of the process at other facilities will be identified including

the size of existing installations, number of years of use, and general performance. The viability of seasonal disinfection, other potential in-plant uses for disinfection chemicals, and the commercial availability of various disinfectants will be investigated. Findings will be reviewed with the MWRA staff, technical consultants and the regulatory agencies, and presented in a technical memorandum. Approval to proceed with Subtask C will be obtained from the Massachusetts Division of Water Pollution Control.

C. Evaluation of Detailed Unit Process Alternatives. The purpose of this task is to conduct detailed Unit Process evaluations of those disinfection processes short listed under FJ-36A, Screening of Potential Unit Processes. Layouts of other selected large facilities will be reviewed for applicability at Deer Island. The unit processes and related facilities will be sized, flow schedules developed, and preliminary layouts prepared. Capital and operating costs will be estimated. Staffing, power, fuel and chemical requirements will be estimated. An assessment will be made as to whether pilot testing would be required to confirm sizing criteria if the process were to be selected as part of the recommended plan. Products from this work package will be continuously reviewed with the MWRA staff, technical consultants, and the regulatory agencies. Results of this work package will be presented in a technical memorandum.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Evaluate Existing Facilities

1. Review historical data and previous/on-going studies and designs
2. Interview key treatment plant staff
3. Review MWRA mitigation commitments
4. Identify existing facilities to be considered for retention or incorporation into the new Deer Island plant

B. Evaluate Potential Unit Processes. For each of the alternative disinfection unit processes identified in Work Package FJ-36A:

1. Using preliminary design criteria, develop approximate area requirements
2. Determine previous experience of the process

a. Number of installations
b. Largest size (unit and total plt. flow)
c. Number of years operating
d. General performance

3. Investigate potential of seasonal disinfection
4. Determine potential in-plant uses of disinfectant (control of filamentous organisms, odor control, etc.)
5. Determine availability of various disinfectants
6. Evaluate with respect to relative capital costs, operating costs, water quality criteria/outfall location and other evaluation criteria
7. Review findings with MWRA staff, technical consultants, and the regulatory agencies
8. Present results in technical memorandum
9. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask C.

C. Evaluation of Detailed Alternatives. For each of the disinfection alternatives short listed in Work Package FJ-36A and using Final Design Criteria developed under FC-30A:

1. Review structural, hydraulic, and mechanical layouts of other selected large facilities
2. Size unit processes and related facilities (delivery, storage, feeding)
3. Determine additional in-plant requirements for disinfectant chemicals
4. Prepare flow schematic
5. Prepare preliminary layouts
6. Estimate average and peak month chemical consumptions
7. Evaluate alternative delivery methods
8. Estimate staffing, power, fuel, and chemical requirements
9. Prepare capital cost estimate
10. Prepare annual operating cost estimate
11. Address need for pilot studies
12. Conduct on-going review with MWRA staff, technical consultants, and the regulatory agencies
13. Present results in technical memorandum

III. WORK PACKAGE PRODUCTS

The work package products include:

1. Memorandum on evaluation of potential unit processes
2. Memorandum on detailed process evaluation

IV. REQUIRED WORK INPUTS

Inputs required to complete this work package include:

1. List of unit processes for evaluation (FJ-36A)
2. Preliminary design criteria (FC-30A) and preliminary evaluation criteria (FJ-36A)
3. Cost-effectiveness analysis criteria (FM-37B)
4. Unit process alternatives for detailed evaluation (FJ-36A)
5. General design criteria and final unit process design criteria (FC-30A)
6. Flows and loads (IC-63A)
7. On-site inspections (FB-20B)

V. RESPONSIBILITY

This work package falls under facilities engineering which is directed by area manager W.F. Callahan. The work group (FF-33) is directed by A.C. Firmin, who is responsible for work package direction and products.

Approved: _____
MWRA

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CDM/S&W
Date: _____
Rev: 7

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FF-33 UNIT PROCESS EVALUATION

WORK PACKAGE: FF-33F AIR EMISSIONS

I. DESCRIPTION OF SCOPE

The scope of this work package is to identify and review available data on air emissions from wastewater treatment facilities, and to evaluate the ability to control air emissions by either selection of wastewater treatment processes or direct control methods. The air emissions include volatile organic compounds (VOCs), odor-causing compounds (such as hydrogen sulfide), and aerosols. (Aerosols are important because they can contain bacteria and viruses.) The results of sampling from WP-FB 2OC will be utilized to identify influent loadings. Work Package EI-50C will assess the impact of the range of emissions projected by this work package (both in terms of air quality and air toxics) and WP EI-50C, together with the Mitigation Program, will establish the levels of control required.

The scope of this work package is as follows:

A. Evaluate Production of Emissions. The purpose of this task is to estimate the quantity of emissions produced by wastewater-treatment processes (identified in FJ 36A). It includes a review of available information and preparation of estimates of production of volatile compounds, odor-causing compounds, and aerosols.

B. Consider Results of Environmental Evaluations of Quantity and Impacts of Emissions. The purpose of this task is to coordinate estimates of the impacts (based upon the State's CHEM/ALL procedures) from the air emissions prepared in Work Package EI-50C. Work package EI-50C includes analyzing the

transport of the emissions, determining concentrations in sensitive areas, and determining the health risk associated with the concentrations where necessary.

C. Investigate Methods to Limit Emissions. The purpose of this task is to determine whether the potential for emissions can be decreased. It includes determining major sources of volatile compounds, odor-causing compounds, and aerosols as well as investigation of treatment processes to limit emissions.

D. Investigate Processes to Collect and Treat Emissions. The purpose of this task is to investigate collection and treatment of volatile compounds, odor-causing compounds, and aerosols.

E. Identify and Evaluate Alternatives for Controlling Emissions. The purpose of this task is to identify and evaluate potential alternatives to control emissions. The evaluation will focus on the Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) in accordance with the State's guidelines. Utilizing the information on health impacts and air quality impacts developed in WP EI-50C, a required level of emission control will be selected. Methods will be evaluated for their ability to attain these goals. The methods include source control, use of processes that limit emissions, and treatment of emissions. Approval to proceed with Subtask F will be obtained from the Massachusetts Division of Water Pollution Control.

F. Evaluate Detailed Alternatives. The purpose of this task is to conduct detailed evaluations of the alternatives resulting from identification and screening. Effects of the alternatives on capital and operating costs will be estimated. Reliability of the alternatives will be reviewed. An assessment will be made of the need for pilot testing to confirm findings.

G. Review with MWRA Staff, Peer Review Consultants and Regulatory Agencies. The purpose of this work package is to assure review of the components of the work package with these groups. Reviews will be conducted for each task of this work package.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Evaluate Production of Organic and Odor Causing Volatile Compounds and Aerosols.

1. Review available information

    a. Conduct literature survey
    b. Collect information from wastewater facilities
    c. Collect information from EPA and research institutions
    d. Evaluate and summarize findings

2. Estimate production of emissions by alternative treatment processes

    a. Develop method to evaluate production
    b. Apply method
    c. Estimate production

3. Present results in a technical memorandum

B. Consider Results of Environmental Evaluation of Quantity and Impacts of Emissions

1. Present findings of emissions production to environmental assessment group, WP EI-50C
2. Provide other process information to WP EI-50C required to conduct air quality modeling
3. Receive results of health hazard analysis from WP EI-50C

C. Investigate Methods to Limit Emissions

1. Determine major sources of emissions

    a. Review data from Work Package FB-20C to determine sources

    b. Determine quantities discharged by major sources from the Industrial Pretreatment Program Local Limits Study

2. Determine whether these sources can be controlled

3. Investigate processes to limit emissions

    a. Identify and list potential processes
    b. Collect and review information about the processes
    c. Determine application

4. Present results in a technical memorandum

D. Investigate Processes to Collect and Treat Emissions

1. Identify alternatives
2. Collect and review information about the processes
3. Determine application
4. Present results in a technical memorandum

E. Identify and Evaluate Alternatives for Controlling Emissions

1. List alternatives, including source control and treatment
2. Develop alternatives
3. Evaluate with respect to capital costs, operating costs, and screening criteria
4. Select alternatives for further evaluation
5. Review findings with MWRA staff, review consultants, and regulatory agencies
6. Present results in a technical memorandum
7. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask F.

F. Evaluate Detailed Alternatives

1. Size units and prepare layouts
2. Estimate capital and operating costs
3. Estimate annual costs of programs
4. Evaluate with respect to capital costs, operating costs, and screening criteria
5. Recommend alternative
6. Review findings with MWRA staff, review consultants, and regulatory agencies
7. Present results in a technical memorandum

G. Review with MWRA Staff, Peer Review Consultants and Regulatory Agencies

1. Prepare information
2. Present findings orally
3. Prepare meeting summaries

III. WORK PACKAGE PRODUCTS

The work package products include:

1. Technical memorandum on production of emissions
2. Technical memorandum on methods of limiting emissions

3. Technical memorandum on processes to collect and treat emissions
4. Technical memorandum showing results of screening analysis
5. Technical memorandum showing results of detailed evaluation of alternatives

IV. REQUIRED WORK PACKAGE INPUTS

Inputs required to complete this work package are listed by subtask:

A. Evaluate Production of Emissions

1. Influent Sampling Data (FB-20C)
2. Unit Process Screening (FJ-36A)
3. Process Design Criteria (FC-30A)

B. Consider Results of Environmental Evaluation of Quantity and Impacts of Emissions

1. Environmental Evaluation of Alternatives (EI-50C)

C. Investigate Methods to Limit Emissions

1. Unit Process Evaluations (FF-33)

D. Investigate Processes to Collect and Treat Emissions

1. Unit Process Screening (FJ-36A)

E. Identify and Evaluate Alternatives for Controlling Emissions

1. MWRA Input
2. Alternative Costs (FM-37)

F. Evaluate Detailed Alternatives

1. Unit Process Screening Report (FJ-36A)

G. Review with MWRA Staff, Peer Review Consultants and Regulatory Agencies

1. MWRA Input

V. RESPONSIBILITY

This work package falls under facilities planning, which is directed by area manager W.F. Callahan. The work group (FF-33) is directed by A.C. Firmin. Mr. S.D. Rafferty is responsible for work package direction and technical products. He will be assisted by Dr. A.B. Pincince and Dr. D. Jenkins.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 7

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FF-33 UNIT PROCESS EVALUATIONS

WORK PACKAGE: FF-33G NOISE CONTROL

I. DESCRIPTION OF SCOPE

The purpose of this task is to evaluate and establish alternative noise control methods and prepare a noise control plan for treatment plant operations and construction activities. This task supports the conceptual engineering work packages by incorporating noise control criteria in the treatment facilities design and construction programs.

The scope of this work package is divided into the following subareas:

A. Review Data. The purpose of this task is to review previous engineering reports, as well as the noise control limitations developed in WP EI-50C Environmental Evaluation of Alternatives.

B. Evaluation Criteria. The purpose of this task is to establish evaluation criteria which will be used to judge the effectiveness and acceptability of noise controlling alternatives as they apply to wastewater treatment equipment, site planning, and facility construction. The evaluation criteria will use numerical noise limitations for different receptors which are established in WP EI-50C.

C. Identify Alternative Concepts. The purpose of this task is to review alternative wastewater treatment equipment and construction noise sources, and identify alternative noise control methods.

D. Develop and Evaluate Alternatives. The purpose of this task is to develop the requisite noise controlling methodology for each major noise source and evaluate the effectiveness and

acceptability of alternative noise controls using the criteria developed in Task B. Acceptability will be based on projected noise levels' compliance with the numerical noise limitations.

E. Recommended Noise Control Plan. The purpose of this task is to prepare a noise control plan using the concepts which were selected in Task

F. Technical Memorandum. The purpose of this task is to prepare a technical memorandum, which summarizes the noise control plan, for submittal to MWRA for use in the facilities plan. The memorandum will include a discussion of assumptions made, development of evaluation criteria, approaches taken and justification for the recommended noise control plan.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Review Data

1. Review the Siting FEIR, FEIS, and previous fast-track program studies. Review all comments from other reviewers of these efforts.

2. Obtain noise limitations from WP EI-50B.

3. Compile and review all mitigation commitments by MWRA.

B. Evaluation Criteria

1. Establish cost, reliability, occupational safety, and environmental factors which will be used to evaluate noise control effectiveness both within the treatment facility (i.e., OSHA and other criteria) and for offsite receptors.

2. Present the evaluation criteria to MWRA and the Acoustical Review Board for concurrence.

C. Identify Alternative Concepts

1. Determine locations and intensities of noise sources from WP's 31B, 32A, 33A, 33B, 33C, 33D, 33E, 33F, 34B, 34C, 36A, 38A, and 40B.

2. Identify noise control methodologies appropriate to each

noise source requiring mitigation.

3. Determine feasibility and effectiveness of noise control alternatives.

D. Develop and Evaluate Alternatives

1. Develop noise control concepts to identify cost, reliability, occupational safety, and environmental factors.

2. Use the evaluation criteria to select recommended concepts.

3. Provide descriptions of selected noise control concepts as appropriate to each process, pumping, and utilities work package to be used in WP FJ-36A, Evaluations of Alternatives.

E. Noise Control Plan

1. For the selected wastewater treatment process, pumping/transport plan, utilities equipment, and site plan, refine the recommended noise controls and prepare an integrated plan.

2. For construction activities associated with the selected facilities, prepare an integrated noise control plan.

F. Technical Memorandum

1.. Describe assumptions, approaches, and results.

2. Present the noise control plans for the treatment facilities and associated construction activities.

III. WORK PACKAGE PRODUCTS

1. Evaluation criteria for the selection of alternative noise controlling concepts.

2. Description of requisite noise control concepts required as input to alternative process trains evaluation (WP-36A), evaluation of pumping stations (WP-34B), alternative electrical power generation evaluations (WP-38A) and environmental evaluation of alternatives (WP 50C).

3. A Noise Control Plan technical memorandum which describes the recommended noise controls for the wastewater treatment facilities and associated construction activities.

IV. REQUIRED WORK PACKAGE INPUTS

Inputs required to complete this work package include:

1. Previous studies, regulatory documents, and background documents.

2. Noise limitations from WP EI-50C.

3. Preliminary descriptions of noise-producing equipment and site plans from WPs 31B, 32A, 33A, 33B, 33C, 33D, 33E, 33F, 34B, 34C 36A, 38A, and 40B.

V. RESPONSIBILITY

This work package falls under facilities engineering, which is directed by area manager W.F. Callahan. The work group (FF-33) is directed by A.C. Firmin. Mr. W.E. Bradley is responsible for work package direction and technical products.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 3

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FF-33 UNIT PROCESS EVALUATIONS

WORK PACKAGE: FF-33H NEED/SCOPING FOR PILOT PLANT

I. DESCRIPTION OF SCOPE

The scope of this work package is to determine the need for pilot testing that might be required to confirm final design criteria (e.g. sizing and selection), provide operator training, or evaluate wastewater reuse in components of the recommended plan. This assessment will be determined on a unit process basis as part of the evaluation of detailed alternatives (Work Packages FF-33A through G). The scope of a pilot program, if required, would be developed as part of the recommended program (Work Package FJ-36A).

The scope of this work package is divided into two major subareas as follows:

A. Assess the need for piloting. The purpose of this task is to assess whether piloting would be required to determine final design criteria for each unit process considered as part of the treatment alternatives included in the detailed evaluation, if that process were a component of the recommended plan. An assessment as to whether piloting would be required for the purpose of operator training or to evaluate wastewater reuse will also be provided. This work will be performed as part of Task B of Work Packages FF-33A-G. Approval to proceed with Subtask B will be obtained from the Massachusetts Division of Water Pollution Control.

B. Scope Pilot Program. The purpose of this task is to scope pilot programs (if any) that may be required as part of the pilot program. This work will be performed as part of Task H of Work Package FJ-36A.

II. RESPONSIBILITY

This work package falls under facilities planning which is directed by area manager W.F. Callahan. The work group (FF-33) is directed by A.C. Firmin. Dr. A.B. Pincince is responsible for work package direction and technical products.

Approved: _____
CDM/S&W

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MWRA

Date: _____

Rev.: __5____

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FG 34 TRANSPORT SYSTEM EVALUATION

WORK PACKAGE: FG 34A SYSTEM HYDRAULICS
FG 34B PUMPING STATIONS
FG 34C INTERISLAND TRANSPORT CONDUIT
FG 34D OUTFALL DISCHARGE SITE SELECTION
FG 34E OUTFALL ENGINEERING

I. DESCRIPTION OF SCOPE

The purpose of this task is to evaluate the route and construction technology for locating and constructing the interisland transport system and new plant outfall. Various hydraulic flow scenarios will be considered in order to allow the "phasing out" of the existing Nut Island and Deer Island Treatment Plants and the sequential "phasing in" of the new Deer Island primary and secondary treatment facilities over the period 1991 through 1999. The scope of this task is divided into five major work efforts as follows.

A. System Hydraulics -- Analyze the hydraulics of the system from the headworks to the outfall by examining existing data and conducting interviews with key system personnel regarding known problems. Develop a plan and hydraulic profiles, from Nut Island to Deer Island and through both the new plant and outfall. The system will reflect the existing facilities to be considered for incorporation into the new system and will consider alternative locations for pumping (influent, intermediate and effluent). Develop preliminary sketches and calculations relating to the pumping locations for cost effectiveness analysis. Develop hydraulic profiles and conduit sizing calculations, using the final flow projections (from Task C).

B. Pumping Stations -- Develop pumping station design criteria based upon the pumping locations and flow conditions developed in the system hydraulics work package. Develop preliminary layouts for feasible pumping alternatives, including pump sizes and arrangements. Develop staffing, power, fuel and other supply needs for a cost effectiveness analysis. Develop conceptual pumping station layouts for the recommended plan.

C. Interisland Transport Conduit -- Make an initial judgement, based on existing information, of the most probable alternative interisland conduit routes. Estabish design criteria based on the conduit size identified above in the systems hydraulics analysis, geotechnical recommendations (Task H) and the environmental considerations (Task K), and the construction considerations (Task S). Investigate alternative construction methods, including but not limited to deep rock or soft ground tunnels, sunken tube tunnels, and cut and cover pipeline construction. Develop details of the alternative conduit layouts, including shafts, and access and estimated implementation times, for the cost effectiveness analysis and for environmental evaluations. Prepare a conceptual design for the recommended plan which reflects the conduit route and construction method.

D. Outfall Discharge Site Selection -- Refer to WP FG 34D, Outfall Site Selection, for a description of scope.

E. Outfall Engineering -- Approval to proceed with Work Package 34E will be obtained from the Massachusetts Division of Water Pollution Control. Using the outfall conduit size, alternative terminus locations and diffuser specifications developed above, as well as the geological investigations (Task H), and the environmental considerations (Task K), develop alternative outfall conduit routes, diffuser types and construction methods. Include a review of existing outfalls to assess the merits of their incorporation into the long-term plans.

Develop sketches, calculations, and other appropriate information on feasible alternatives for the cost effectiveness analysis. Prepare a conceptual design and preliminary layout of the recommended pipe route, construction method and diffuser design.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 4

(12/23/86)

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FG 34 - TRANSPORT SYSTEMS EVALUATION

WORK PACKAGE: FG 34D - OUTFALL DISCHARGE SITE SELECTION

I. DESCRIPTION OF SCOPE

The scope of this work package is to marshal existing oceanographic data, supplemented by a limited 3-month data collection program described below; projected flow rates and constituent loading of effluent; mappings of commercial, navigational, and environmental resource areas; and geotechnical information as required, to select an area for the outfall discharge which will meet water quality standards of the Commonwealth of Massachusetts. Final site selection will follow the work in WG EK 41, and will be scoped at that time.

The scope of this work package is divided into eleven major subareas, as follows:

A. Review Existing Studies. The purpose of this task is to review current scientific, engineering, administrative and regulatory documents.

B. Map Resource Areas. The purpose of this task is to use existing information and some interviews to develop a preliminary map of resource areas to include recreational, commercial, navigational, and ecological resources in the study area. This map will aid in the coarse screening of potential diffuser sites.

C. Establish Screening Criteria. The purpose of this task is to review regulatory documents and hold discussions with state officials to adopt criteria to meet when siting the diffuser. These will include criteria based on State water quality standards and a recognition of potential changes thereto, and on engineering judgement.

D. Coarse Screening of Potential Outfall Sites. The purpose of this task is to use the map of resource areas, and EPA's initial dilutions models to identify those areas in which an outfall could potentially be located.

E. Supplemental Field Program. The purpose of this task is to collect field data at potential outfall locations to supplement the existing database. The field program will consist of three (3) separate 10-day surveys to be conducted during July and August 1986. The survey will include drogue studies, draft card releases, and profiles of conductivity/temperature/ dissolved oxygen.

F. Whole Effluent Testing. The purpose of this task is to perform serial dilution of the existing effluent to determine impact levels for a limited number of species. The effluent from both plants will be collected and flow proportioned between the plants. Tests will conform to EPA guidelines. This work will assist in establishment of criteria for a secondary effluent discharge.

G. Oceanographic Data Interpretation. The purpose of this task is to analyze existing and collected oceanographic data, including model studies, together with wind data from Logan Airport, to describe circulation mechanisms in the study area.

H. Analyze Potential Sites. The purpose of this task is to predict and map the patterns of transport and dispersion of the wastewater plume for each potential site, including the existing Deer Island site, using EPA's initial dilution models and a suite of MIT models already applied (calibrated) to Massachusetts Bay/Boston Harbor, together with information obtained from oceanographic data interpretation. The analyses will include determining constituent concentrations at the boundary of the zone of initial dilution (ZID), and impacts in the far field on resource areas.

I. Evaluate Feasible Alternatives. The purpose of this task is to rank the sites according to the established criteria. In addition, a brief survey will be performed to determine that there is no obvious reason to discount a site from further consideration.

J. Participate in scoping environmental reviews. The purpose of this task is to prepare the oceanographic, water quality, and ecologic portion of the study plans for the preparation of the EIR/EID documents detailing the types of measurements and analyses to be performed to assess the recommended diffuser

area(s).

K. Technical Memorandum. The purpose of this task is to prepare a technical memorandum for submittal to MWRA staff, for use in the facilities plan, and for preliminary design reports. The memorandum will include a complete discussion of all assumptions made, approaches taken, and results obtained.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Review existing studies

1. Review 301(h) waiver applications for MDC(MWRA), Lynn, Swampscott, South Essex and Gloucester, and related documents
2. Review EG & G report on "Oceanographic Study of Various Siting Options for the Deer Island Treatment Plant"
3. Review various MIT reports on modeling Massachusetts Bay,and related studies
4. Review other sources, including from New England Aquarium University of Massachusetts, and Woods Hole Oceanographic Institute

B. Map resource areas

1. Recreational areas (including swimming and sport fishing)
2. Commercial (fishing, shellfish, spawning areas)
3. Navigational and dredging
4. Ecological

C. Establish screen criteria

1. Review regulatory documents
2. Hold discussions with state officials
3. Develop "engineering criteria"

    a. Circulation patterns
    b. Ranking resource areas

D. Coarse screening of potential outfall sites

1. Run EPA's initial dilution models to determine minimum offshore distance to meet criteria
2. Run analytic or observation models to illustrate effects of circulation patterns
3. Screen resource areas
4. Identify potential outfall sites for field studies

E. Supplement field program

1. First survey

    a. Release six drogues per day for 8-10 days in pairs and track during daylight hours
    b. Measure vertical profiles of conductivity/ temperature/oxygen before and during drogue studies

2. Second survey

    a. As first survey
    b. Release 20 top and bottom drifters per day for 10 days and plot returns

3. Third survey

    a. As first survey

F. Whole effluent testing

1. Perform serial dilution of existing effluent
2. Determine impacts on limited number of resident species

G. Oceanographic data interpretation

1. Describe long-term circulation patterns in Massachusetts Bay and Boston Harbor
2. Describe tidal and wind-driven components
3. Determine magnitude and frequency distribution of wind-driven component from drogue data and wind records
4. Develop a cumulative probability function for height-of-rise for a given diffuser layout based on vertical profile data

5. Determine frequency distribution of current speed and duration

H. Analyze potential sites

1. Apply initial dilution models to determine zid concentrations for various ambient currents and stratification conditions
2. Apply far-field models to determine impacts on resource areas
3. Determine long-term advective trends
4. Examine effects of tidal currents
5. Examine effects of predominant and extreme wind-induced currents

I. Evaluate feasible alternatives

1. Rank sites according to adopted criteria
2. Perform screening survey (either diving, cameras and/or grab samples)
3. Provide sketches, calculations, and other appropriate information about the feasible alternatives

J. Preliminary diffuser design

1. Length and orientation
2. Port size and spacing

K. Develop EIR plan of study

1. Detail oceanographic measurements
2. Describe data reduction and interpretation
3. Define subsequent analyses to be performed

L. Technical memorandum

1. Discuss assumptions made
2. Describe approaches taken
3. Detail results
4. Present recommended outfall locations

III. WORK PACKAGE PRODUCTS

The work package products include:

1. A technical memorandum presenting the selected site, detailing the site selection process, and providing supporting data and interpretations. This memorandum will contain a preliminary diffuser layout to be used in the outfall engineering task.

IV. REQUIRED WORK PACKAGE INPUTS

Inputs required to complete this work package include (See Attachment B):

1. Initial estimated flow and loading data
2. Final estimated flow and loading data (WP IC 53A)

V. RESPONSIBILITY

This work package will be directed by Dr. M.S. Rosenberg. Dr. R. Walton will be responsible for day-to-day work package management and technical products, including managing the subcontractors, Battelle and Ocean Surveys Inc. (OSI). Dr. N.H. Brooks of Caltech will assist in planning and review. A Technical Review Committee will review the approach, assumptions, and recommendations.

Approved: _____
CDM/S&W

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MWRA

Date: _____

Rev.: 6

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FH - 35 SURVEY/SUBSURFACE INVESTIGATIONS

WORK PACKAGE: FH - 35A - LAND SURVEY/SUBSURFACE INVESTIGATION
FH - 35B - MARINE SUBSURFACE INVESTIGATIONS

I. DESCRIPTION OF SCOPE

The scope of this work group is to perform a subsurface investigation program on land and off-shore to characterize the soil and rock conditions under the proposed facility and related water conveyance structures. This work group is divided into two work packages: WP 35A includes all on-shore investigations and studies for facilities on land, specifically Deer Island, Long Island, and Nut Island; and WP 35B includes all marine investigations and studies for water conveyance structures off-shore, specifically the interisland transfer conduit between Nut and Deer Islands, the effluent discharge pipe, and the ocean outfall structure.

The scope of the on-shore Land Subsurface Investigations (WP 35A) is divided into 6 major subareas, as follows:

A. Taking into account the existing survey data and maps, prepare a base map that will be used in the facilities study. Surveys have been performed on Deer and Nut Islands during previous studies. Metcalf & Eddy prepared a map of both islands during the site options study in 1981 at a scale of 1 in. = 200 ft with 5 ft contour intervals. A map of both islands was later prepared by H&E at a scale of 1 in. = 40 ft with 2 ft contour intervals. These maps will be field checked and updated to include items required for developing the facilities plan such as utilities, easements, and existing structures. The base map product will be redrawn to a scale of 1 in. = 40 ft, with 2 ft contour intervals providing complete coverage of both Deer and Nut Islands.

B. Inventory existing boring data available from previous studies and from previous construction projects on the three islands. The purpose of this task is to inventory the existing subsurface data base that is available on Deer Island in the vicinity of the existing plant, and along the shoreline towards the present outfall, to determine its applicability to the secondary treatment facility. Relevant soils data will be abstracted for use in the facilities plan, where possible. A similar study of existing subsurface conditions will be made for Long Island and Nut Island. MWRA will be informed of any data determined to be unacceptable for use in this study.

C. Perform field studies. The purpose of this task is to take additional borings on the islands to augment existing data abstracted from previous studies. On Deer Island, any additional borings will be drilled 25 ft into bedrock to determine the soil and rock profile under the new facilities so that the foundation design criteria can be determined. Available information indicates that several previous borings have been drilled into bedrock on Deer Island, but these may not be located at the future facilities site. Many of the existing borings were taken in the vicinity of the existing plant and along the shoreline where piers are planned. Any new borings will be used to establish the depth and nature of drumlin soils and also the depth and quality of the bedrock under the island. Test pits, probes, or trenches may also be used to determine the nature and quality of the surficial soils on the drumlin as an aid in developing a spoil disposal or reuse plan for the excavated materials. Additional borings may be taken on both Long Island and Nut Island, to augment subsurface data existing on these islands. Current budget assumes a total of four on-shore borings.

D. Perform laboratory tests. The purpose of this task is to conduct laboratory tests on soil samples retrieved from the borings and test pits. The gradation of the drumlin material must be known before determining whether it has commercial value, or whether off-island disposal is required. A limited number of index and strength tests will be required to establish the foundation design criteria. If a potential for contamination of these soils is established, additional chemical testing will be performed.

E. Analyze and interpret data. The purpose of this task is to analyze and interpret the results of the geotechnical field investigations and to extrapolate subsurface conditions under existing facilities from available data. Foundation recommendations, construction methodology, and reuse options for excavated materials will be

developed.

F. Prepare technical memorandum summarizing the geotechnical investigations. The purpose of this task is to assemble all of the data, interpretations, and design criteria prepared in this work package into one summary report. The summary will identify any portions of the existing data base rejected for use in this study.

The scope of the Marine Subsurface Investigations (WP 35B) is divided into 6 major subareas, as follows:

A. Using existing survey data and maps, prepare a base map of the off-shore study area. The purpose of this task is to prepare a base map that will illustrate the location of the marine borings and geophysical surveys in the vicinity of the alternate routes for the conveyance conduits.

B. Inventory existing boring data and geophysical surveys performed in the site area for previous projects and studies in the harbor. The purpose of this task is to inventory these data to determine their suitability for use in developing the marine subsurface investigation program and for defining soil and rock conditions in the facilities plan study areas. Previous sediment chemistry data will be reviewed and included in the data base.

C. Conduct marine subsurface investigations. The purpose of this task is to determine the depth and characteristics of soil and rock along potential alignments of the interisland transfer conduit as developed in WP 34C and the effluent discharge pipe and outfall structure as developed in WP 34D. The program will be structured so that low feasibility construction options could be eliminated early, thereby directing the investigations towards more feasible activities.

For the discharge section, 2 borings will be taken within approximately 2 miles of Deer Island to supplement existing borings in alternate discharge locations. These borings will be drilled 25 ft into rock. Geophysical surveys will be made to extend the coverage into deeper water beyond 2 miles and in the general area of the proposed discharge pipe and outfall structure. The geophysical surveys will include fathometer measurements and sub-bottom profiling using reflection or refraction techniques.

Similar geophysical surveys and 3 additional borings will be made along potential routes for the interisland transfer conduit and along the outer portion of an alternative outfall location south of

Brewster Islands. Sediments will be retrieved in both off-shore study areas for chemical testing.

D. Perform laboratory tests. The purpose of this task is to determine physical properties of soil and rock samples from the borings to determine the adequacy of these materials to support buried pipes, sunken tubes, or rock tunnels. Physical and chemical tests will be performed on sediments to characterize them in accordance with the criteria of 314CMR9.03.

E. Analyze and interpret data. The purpose of this task is to analyze and interpret the results of the geotechnical investigations and present recommendations for depth and routing of the underwater conveyances, design criteria, and other input to Work Package FS 40B, Construction Planning, to be used for the development of construction methodology.

F. Prepare technical memorandum summarizing the geotechnical investigations. The purpose of this task is to assemble all of the data, interpretations, and design criteria prepared in this work package into one summary report. The summary will identify any portions of the existing data base rejected for use in this study.

II. TASKS AND ACTIVITIES

WP 35A Land Survey Subsurface Investigations

The tasks and activities associated with this work package include:

A. Surveying

1. Prepare site maps of Deer Island and Nut Island by updating base maps prepared in previous planning studies with site surveys.

2. Conduct field surveys to locate borings, test pits, and trenches.

B. Inventory existing boring data.

1. Collect and inventory existing data, and assess its adequacy for supporting development of the facilities plan.

2. Study preliminary engineering proposals for site facilities from Work Groups FC 30, Engineering Design Criteria; FD 31, Facilities Engineering; FE 32, Nut Island Conceptual Review;

FF 33, Unit Process Evaluation; and FG 34, Transport System Evaluation.

C. Perform field studies.

1. Develop a subsurface investigation program for the facilities plan, and prepare a summary of investigation plans and methods for review by others. Review with MWRA prior to initiation of field work.

2. Locate borings and other field tests.

3. Procure services of a boring and test pit contractor.

4. Supervise field investigations.

5. Prepare boring logs.

D. Perform laboratory testing.

1. Develop test program, prepare summary of methodology and procedures for review by others.

2. Perform index and gradation tests on soil samples and strength tests on rock samples.

E. Analyze and interpret data.

1. Prepare geologic cross-sections.

2. Summarize field and laboratory data.

3. Determine foundation design criteria.

4. Study disposal/reuse options for excavated material.

F. Prepare technical memorandum.

1. Prepare a technical memorandum providing design criteria, foundation recommendations, and spoil disposal options. The results of all field and laboratory testing will be included.

WP 35B Marine Subsurface Investigations

A. Surveying

1. Locate marine borings and present locations on the base map.

B. Inventory existing boring and geophysical data.

1. Collect and inventory existing data, and assess its adequacy for defining subsurface conditions along the potential conveyance routes.

2. Review existing sediment data and include in data base.

C. Perform field studies.

1. Based on alternate routes from WP 34C and WP 34D, develop a subsurface investigation program for the marine investigation program and prepare summary of investigation plan and methods for review by others. Review with MWRA prior to initiation of field work.

2. Procure services of boring and geophysical contractors.

3. Perform field surveys to locate borings and geophysical lines.

4. Supervise field investigations.

5. Prepare boring logs.

D. Perform laboratory testing.

1. Develop test program, prepare summary of methodology and procedures for review by others.

2. Perform physical tests to determine strength, compressibility, and index properties of soil and rock samples.

3. Perform physical and chemical tests on sediment samples to characterize them in accordance with the criteria of 314CMR9.03.

E. Analyze and interpret data.

1. Prepare geologic cross-sections based on borings and geophysical profiles.

2. Summarize field and laboratory data.

3. Determine design criteria, routing, depth, and construction

techniques for the conveyance and outfall structures.

F. Prepare technical memorandum.

1. Prepare a technical memorandum providing design criteria, routing, depth, and recommended construction techniques for the conveyance and outfall structures. The results of all field and laboratory testing will be included.

III. REQUIRED INPUTS

A. Existing geotechnical data, including data from Site Options Study, from Havens & Emerson's previous Facility Planning Project for Deer Island, and other sources relevant to the study areas.

B. Preliminary facility information and location of future structures, site grades, routes, pipe sizes, and preliminary construction requirements.

IV. WORK PACKAGE PRODUCTS

A. WP 35A

1. Summary of on-island field subsurface investigations and laboratory test program, methodologies, and procedures.

2. Technical memorandum describing the islands' geotechnical characteristics, design criteria for facility structures, and drumlin excavation/disposal reuse options.

B. WP 35B

1. Summary of marine field subsurface investigation and laboratory test programs, methodologies, and procedures.

2. Technical memorandum presenting data from the marine geotechnical investigations and design criteria for conveyance structures.

V. RESPONSIBILITY

Mr. Wayne Kilker is responsible for the execution of this work package; Mr. Gregory Sankey is the work group leader, under the direction of Mr. William Callahan.

Approved: _____
MWRA

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CDM/S&W

Date: _____

Rev: 7

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FJ-36 PROCESS ALTERNATIVE IDENTIFICATION AND EVALUATION

WORK PACKAGE: FJ-36A IDENTIFY AND EVALUATE TREATMENT ALTERNATIVES

I. DESCRIPTION OF SCOPE

The scope of this work package is to identify and evaluate alternatives for the new treatment facilities. The work will be performed in two phases - an initial screening of individual unit processes in order to formulate alternatives to be considered for detailed evaluation and an evaluation of those alternatives in order to select a recommended alternative. This work package requires coordination with two other major projects; residuals and water transportation (pier consultant).

The scope of this work package is divided into nine major subareas as follows:

A. Identify Potential Unit Processes. The purpose of this task is to develop a list of unit processes for initial screening. The processes will be subgrouped into 1) preliminary treatment and headworks, 2) primary treatment and residual collection, 3) secondary treatment and residual collection, 4) disinfection, and 5) emission control.

B. Develop Preliminary Evaluation Criteria for Screening Unit Processes. The purpose of this task is to establish uniform evaluation criteria (criteria other than the preliminary design criteria developed under WP FC-30A) which will be used in the screening of unit processes. The criteria will be presented to MWRA in a technical memorandum for review and approval prior to screening of alternatives. Criteria will include MWRA mitigation commitments, relative costs, technical, operations, and environmental impact parameters. Criteria will

incorporate RMFP considerations. Criteria will be used in the unit process evaluations (FF-33A through E); the results from which will be the basis for screening under the following Task C.

C. Screening of Potential Unit Processes. The purpose of this task is to utilize the results of WP FF-33 (Task B) to screen potential unit processes, developed in Task A, to a short list of those considered viable for detailed evaluation. This evaluation will be subject to a peer review process before subsequent activities are continued.

D. Develop Process Trains for Detailed Evaluation. The purpose of this task is to utilize the short list prepared under Task C to develop complete treatment alternatives to be considered for detailed evaluation. Processes composing these trains will be subdivided into the process groupings used in Task A. Approval to proceed with Subtask E will be obtained from the Massachusetts Division of Water Pollution Control.

E. Screening Report. Prepare a report which incorporates information from the unit process screening criteria memorandum (FC-30A) and the evaluation of potential unit process memorandum (FF-33A through E); summarizes the results of the screening of unit processes and presents the alternatives recommended for detailed evaluation. Design criteria developed as part of Work Package FC-30A will also be included in this report.

F. Develop Final Evaluation Criteria. The purpose of this task is to develop final criteria for evaluation of the treatment alternatives considered for detailed analysis (this criteria is that other than the process design criteria developed in Work Package FC-30A). Final criteria will be a refinement of the evaluation criteria prepared in Task B. These criteria will be used in the evaluation of detailed unit process alternatives under WP FF-33A through E. Approval to proceed with Subtask G will be obtained from the Massachusetts Division of Water Pollution Control.

G. Evaluation of Alternative Treatment Trains. This task will input general design criteria (FC-30A) and the results of detailed unit process evaluations (FF-33A through E) to rank alternative treatment trains incorporating other considerations listed under inputs.

H. Select Recommended Treatment Alternative. The purpose of this task is to select a recommended treatment train taking into account technical, operational, mitigation, areal, environmental and financial concerns. This selection will be subject to peer review, MWRA review and approval.

I. Detailed Evaluation Report. The purpose of this report is documentation of the work produced in Tasks F-H.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Identify Potential Unit Processes

1. Preliminary Treatment at existing and proposed headworks facilities and at Deer Island Treatment Plant. Unit processes to be examined will include:

   - screening
   - grit removal
   - emission control

   Coordination of this effort with the MWRA staff, the headworks upgrade consultant, the residuals hauling contractor, and the RMFP consultant will be required.

2. Primary Treatment and Residuals Collection. Unit processes to be examined will include various configurations of primary treatment, sludge and scum collection methods, and a primary sludge and scum pumping station. Coordination of this effort with MWRA's RMFP Staff and Consultant will be required.

3. Secondary Treatment and Residuals Collection. Unit processes will include secondary treatment (biological and physical/chemical including secondary sedimentation), sludge and scum collection and sludge and scum pumping. Coordination with RMFP Staff and Consultant and the sedimentation upgrade consultant also required.

4. Disinfection. Alternative methods of disinfection will be evaluated including on-site generation of hyprochlorite and alternatives not requiring chlorine. Coordination with the EID (EI-50) and outfall siting (FG-34D) work packages required.

5. Emission Control. Various alternatives for the control of odor, VOC's, aerosols and toxics as required will be evaluated. Coordination with RMFP staff and consultant required.

B. Develop Preliminary Evaluation Criteria. Criteria will address the MWRA Mitigation commitments and will include as a minimum:

1. Relative capital, operating and maintenance and annualized costs.
2. Reliability, track record
3. Area requirements
4. Construction duration and sequencing considerations
5. Safety, complexity
6. Odor and aesthetic concerns
7. Environmental impacts
8. Harbor enhancement
9. Institutional considerations
10. Utility and operator needs
11. Ease of construction
12. Schedule implications
13. RMFP needs

These criteria, any suggested additional criteria, and how they will be used in the screening analysis will be presented to MWRA for their review and approval.

C. Screening of Potential Unit Processes. This task will short list which unit processes are to remain for detailed evaluation using the preliminary evaluation results developed under WP FF-33A through E.

D. Develop Process Trains for Detailed Evaluation. The tasks and activities associated with this work package include:

1. Develop alternative process trains incorporating short listed unit processes.

2. Consider separate or combined treatment for North and South tributary areas.

3. Consider treatment requirements for wet weather flows and other than conventional pollutants. (From Work Package IC-63B).

4. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask E.

E. Screening Report. The tasks and activities associated with this work package include:

1. Preparation of report including introduction, initial listing of potential unit processes, screening criteria, results of

screening evaluations and development of complete process trains for further evaluation.

2. A method for incorporation of the Interim Screening Report and the design criteria from Work Package FC-30A into the Facilities Plan will be developed.

F. Develop Final Evaluation Criteria. In addition to the utilization of criteria developed for the screening of unit processes the following criteria will be considered:

1. Compatibility of unit processes to one another within a process train.

2. Compatibility of unit processes with site.

3. Experience of other large municipal treatment facilities with similar process trains.

4. RMFP needs

5. Other factors identified through MWRA review, the public participation program (Work Package IL-60A) and the EID (EI-50).

6. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask G.

Final evaluation criteria will be presented to MWRA for review and approval.

G. Evaluation of Alternative Treatment Trains. The tasks and activities associated with this work package include:

1. Review and incorporate results of plant layouts for various treatment alternatives from FD-31B.

2. Develop layouts for non-process facilities including personnel, maintenance and security.

3. Review and incorporate results of cost effectiveness analysis from FM-37B.

4. Incorporate results of all other non-cost and environmental factors from EI-50.

5. Incorporate considerations from public participation program IL-60.

6. Compare feasible alternatives, identifying advantages and disadvantages.

7. Coordinate with RMFP staff and consultants.

H. Select Recommended Treatment Alternative. The tasks and activities associated with this work package include:

1. Incorporate WP FD-31B detailed layouts of the recommended plan.
2. Summarize final process train design criteria.
3. Prepare final mass balance of process train.
4. Summarize all support requirements (utility, operator needs, etc.)

I. Detailed Evaluation Report. The tasks and activities associated with this work package include:

1. Preparation of report documenting work in Tasks F-H.

III. WORK PACKAGE PRODUCTS

The work package products include:

- Technical memoranda discussing preliminary evaluation criteria for use in unit process evaluations (FF-33).
- Interim screening report for MWRA review and approval.
- Technical memorandum presenting final evaluation criteria for use in evaluation of detailed alternatives.
- Detailed evaluation report for use in development of recommended plan (PT-70A).

IV. REQUIRED INPUTS

Inputs required to complete this work package are listed by subtask.

A. Identify Alternative Unit Processes
   - Information from on-site inspection (FB-20B)

B. Develop Screening Criteria
   - MWRA input

C. Screening of Unit Process
   - Preliminary flows and loads (IC-63A)

- Process design criteria (general)(FC-30A)
- Unit process evaluations (FF-33)
- ORC, TRC and Peer Review

D. Develop Process Trains for Detailed Evaluation
- Influent sampling data (FB-20C)
- Performance/removal criteria (IC-63B)

E. Interim Screening Report
- Draft final flows and loads report (IC-63A)
- Specific engineering design criteria (FC-30A)
- Harbor perspective (FD-31A)
- Deer Island conceptual layout (FD-31B)
- Nut Island conceptual layout (FE-32A)
- MWRA input

F. Develop Final Evaluation Criteria
- MWRA input
- Peer review
- EID/EIR

G. Evaluation of Alternatives
- Final flows and loading report (IC-63A)
- Unit process evaluations (FF-33)
- Harbor perspective (FD-31A)
- Deer Island site planning (FD-31B)
- Nut Island site planning (FE-32A)
- Transport system evaluation (FG-34)
- Alternative costs (FM-37)
- Utility needs (FO-38)
- Operator needs (FP-39)
- Construction considerations (FS-40)
- Influent flow metering and sampling (FB-20C)
- Reliability/flexibility analysis (FJ-36B)
- Peer Review
- EID/EIR

H. Select Recommended Treatment Alternative
- MWRA input
- ORC, TRC and Peer review

I. Interim Detailed Evaluation Report
- All subtasks

V. RESPONSIBILITY

This work package falls under facilities planning which is directed by area manager W.F. Callahan. The work group (FJ-36) is directed by A.C. Firmin. Mr. J.F. Donovan is responsible for work package direction and technical products.

Attachment B

Schedule
Work Package FJ-36A
Identify and Evaluate Treatment Alternatives

Activity	Start	Finish
A - Identify Alternative Unit Processes	7-14-86	8-15-86
B - Develop Screening Criteria	8-4-86	8-15-86
C - Screening of Alternative Unit Processes	8-18-86	10-15-86
D - Develop Process Trains for Detailed Evaluation	9-15-86	11-1-86
E - Interim Screening Report	11-3-86	12-1-86
F - Develop Final Evaluation Criteria	1-5-87	1-26-87
G - Evaluation of Alternatives	3-2-87	4-10-87
H - Select Recommended Treatment Alternative	4-13-87	5-1-87
I - Interim Detailed Evaluation Report	5-4-87	6-5-87

Approved: _____
MWRA

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CDM/S&W
Date: _____
Rev: 2

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FJ-36 PROCESS ALTERNATIVE IDENTIFICATION AND EVALUATION

WORK PACKAGE: FJ-36B RELIABILITY/FLEXIBILITY ANALYSIS

I. DESCRIPTION OF SCOPE

The scope of this work package is to evaluate each of the treatment alternatives considered for detailed evaluation as to reliability and flexibility.

The scope of this work package consists of the following:

A. Investigate reliability and flexibility. Each of the alternatives considered for detailed evaluation will be evaluated for reliability. This evaluation will include the overall treatment plant and major components thereof. Items considered will include effluent compliance, insurance of compliance with MWRA mitigation commitments, and overall plant operation. Reliability, for the purposes of this evaluation, can be taken to mean the degree of assurance that the plant and its components will perform consistently as designed under the expected range of design conditions.

   Each alternative will also be evaluated for flexibility. This evaluation will include the overall treatment plant and major components.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Investigate the reliability and flexibility of each of the treatment alternatives considered for the detailed evaluation:

   1. Determine the reliability of individual major components and treatment plant as whole in terms of effluent compliance, meeting of MWRA mitigation commitments, and overall operation. Selected treatment plants of similar size

and process/equipment will be analyzed to determine expected reliability, including programmed and non-programmed down time of major components.

2. Determine the flexibility of each alternative under conditions of changing flows and loads, future changes in regulatory requirements, and the ability to be operated under abnormal conditions such as strikes, temporary loss of power or chemical supply.

B. Prepare technical memorandum

1. Prepare technical memorandum presenting the results of the reliability/flexibility analysis described above.

III. WORK PACKAGE PRODUCTS

The work package product consists of a technical memorandum presenting results of the reliability/flexibility analysis.

IV. REQUIRED INPUTS

Inputs required to complete this work package include:

1. Alternatives for detailed evaluation (FJ-36A)
2. General design criteria and unit process design criteria (FC-30A)
3. Process evaluations (FF-33A, 33B, 33C&D, 33E, 33F and 33G)
4. Flows and Loads (IC-63B)

V. RESPONSIBILITY

This work package falls under facilities engineering which is directed by area manager W.F. Callahan. The work group (FJ-36) is directed by A.C. Firmin who will also be responsible for work package direction and technical products.

Approved: _____
CDM/S&W

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MWRA

Date: _____
Rev: 5

Work Summary: F - FACILITIES ENGINEERING
Work Group: FM 37 - COST
Work Package: FM 37A - COST ESTIMATE

I. Description of Scope

The purpose of this task is to prepare a capital cost estimate of the selected plan, and to coordinate the preparation of preliminary capital cost estimates for the selected facilities/equipment which were developed in each of the engineering work groups FD-31,FE-32, FF-33, FG-34, FJ-36, FO-38, and FS-40.

The scope of this work package is divided into the following subareas:

A. Examine Data The purpose of this task is to examine conceptual engineering products for the selected facilities, and preliminary cost estimates which were prepared in the conceptual engineering work packages.

B. Finalize Cost Estimate The purpose of this task is to finalize the cost estimate for the selected secondary wastewater treatment facilities.

II. Tasks and Activities

A. Examine Data

1. For the selected secondary wastewater treatment facilities, examine preliminary cost estimates, drawings, and facilities descriptions.

2. Examine any modifications to preliminary concepts which are developed for the selected facilities. Technical memoranda from each of the conceptual engineering work groups listed above are the engineering bases for the final cost estimate.

3. Inventory unit costs from WP FM-37B; examine cost development procedures in Project Administrative Directive (PAD).

B. Finalize Cost Estimate

1. Verify material quantities takeoffs.

2. Verify equipment costs.

3. Compile costs and labor rates; finalize total budget costs.

4. Estimate capital costs including construction, management, engineering, and contingency for 1987, 1991, 1995, and 1999.

III. Work Package Products

1. Capital cost (budget) estimate for the selected facilities at present day (1987) and for selected construction milestone dates as identified above.

IV. Required Work Package Inputs

Inputs required to complete this work package include:

1. Unit costs from WP FM-37B; cost development procedures from PAD.

2. Preliminary cost estimates; drawings, and technical memoranda; facilities descriptions for the selected facilities from each of the conceptual engineering work groups D, E, F, G, J, O, and S.

V. Responsibility

Mr. William R. Barry is responsible for the execution of this work package; Mr. John Donovan is Technical Manager for this work package; Mr. William Callahan is the Area Manager.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 6

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FM-37 COST

WORK PACKAGE: FM-37B COST EFFECTIVENESS ANALYSIS

I. DESCRIPTION OF SCOPE

The scope of this work package is to develop common parameters to be used in all cost-effectiveness comparisons. Cost-effectiveness comparisons of the treatment alternatives considered for the detailed analysis will be conducted as part of this work package. Parameters developed as part of this scope will include unit costs for labor and chemicals and parameters for the respective cost-effectiveness comparisons (i.e. design lives, discount rate, salvage values, base year, capital cost time basis, etc.).

The subareas of this work package include: the development of guidelines for unit process cost evaluations; development of procedures to determine life cycle costs; and a complete cost effectiveness analysis on all of the detailed alternatives. The cost effectiveness analysis will be reviewed with MWRA and recommendations will be made.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Develop Guidelines for Unit Process Cost Evaluations

B. Develop Procedure for Determining Life-Cycle Costs

1. Review current EPA regulations (40 CFR35 Subpart E, Appendix A)

2. Determine which current and future MWRA projects will be considered sunk costs in the cost effectiveness analysis

3. Determine discount rates for analysis (consider using expected MWRA borrowing rate for discount rate in addition to the EPA discount rate) of detailed alternatives

4. Determine the base year and planning period for the analysis

5. Determine the base year for capital cost estimates

6. Discuss use of cost escalation factors for energy use with EPA

7. Determine methodology for evaluation of Innovative and Alternative cost preference

8. Determine method for including financing costs in analysis

9. Review Life-Cycle Cost Procedure with the MWRA

10. Coordinate with the RMFP

11. Prepare technical memoranda on cost effectiveness analysis procedure and unit costs

C. Conduct the Cost Effectiveness Analysis Alternatives on Detailed Alternatives

1. Conduct the analysis according to the methodology developed in Tasks A and B (in accordance with 40 CFR, Subpart E, Appendix A)

2. Conduct sensitivity analysis by changing unit costs discount rates, or making other adjustments to base costs .

3. Review Cost-Effectiveness Analysis with MWRA

4. Prepare memorandum presenting rankings of the detailed alternatives

III. WORK PACKAGE PRODUCTS

The work package products include:

1. Technical memoranda on unit costs and guidelines for unit process cost evaluation

2. Technical memoranda on cost effectiveness analysis procedures

IV. REQUIRED INPUTS

Inputs required to complete this work package include:

1. Capital and Operating Costs from other work packages

2. Coordination with RMFP

V. RESPONSIBILITY

This work package falls under facilities engineering which is directed by area manager W.F. Callahan. The work group (FM-37) is directed by John F. Donovan who is also responsible for work package direction and technical products.

SCHEDULE

Work Package FM-37B

Cost Effectiveness Analysis

Activity	Start	Finish
A. Develop Unit Costs	8/4/86	9/12/86
B. Develop Procedures for Determining Life-Cycle Costs	8/4/86	10/30/86
C. Conduct Cost Effectiveness Analysis	3/2/87	4/10/87

Approved: _____
MWRA

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CDM/S&W

Date: _____

Rev: 6

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FO - 38 UTILITY NEEDS

WORK PACKAGES: FO-38A POWER, HEAT, AND FUEL
FO-38B OTHER UTILITIES

I. DESCRIPTION OF SCOPE

The scope of this work group is to evaluate previous studies and estimates of utility needs; identify utility needs for construction and operation of both Deer Island and Nut Island facilities, including the existing remote headworks; evaluate alternative means for providing the requisite utilities; select and recommend a plan for supplying the utilities to Deer Island, Nut Island, and, as appropriate, Long Island and the existing remote headworks; and provide a conceptual design, implementation schedule, and cost estimates for the recommended plan.

The scope of this work group is divided into two work packages, each having the following major subareas:

Work Package FO-38A Power, Heat and Fuel

A. Evaluate Existing Studies. The purpose of this task is to evaluate previous studies and current regulatory documents.

B. Determination of Power Sources. The purpose of this task is to establish a preliminary estimate of electrical power needs and review availability of constraints associated with potential sources to determine whether off-island, on-island, or a

combination of sources could be developed to support treatment operations. Coordination with the Residuals Management Facilities Plan (RMFP) effort is required.

C. Preliminary Power, Heat, and Fuel Study-Deer Island. The purpose of this task is to estimate heat and fuel requirements, to evaluate alternative power sources and to identify the most feasible plan for providing primary and backup electrical power.

D. Technical Memorandum. The purpose of this task is to prepare a technical memorandum for submittal to MWRA staff, which summarizes the results of the preliminary Power, Heat and Fuel Study and will serve as a basis for subsequent, more detailed evaluations. Approval to proceed with Subtask E will be obtained from the Massachusetts Division of Water Pollution Control.

E. Finalize Power, Heat and Fuel Systems Needs. The purpose of this task is to evaluate alternatives for providing primary and backup power which were determined feasible in Task C, and to finalize the plan for providing/using electrical power, heat, and fuel at Deer Island, Nut Island, Long Island, and the remote headworks.

Work Package FO-38B Other Utilities

A. Estimate Water Uses. The purpose of this task is to estimate the total potable, protected, and plant water needs for Deer Island, and Nut Island, during construction and operation. Coordination with the RMFP is required.

B. Characterize Water Availability. The purpose of this task is to determine the adequacy of the supply in terms of flow and pressure and the condition of existing potable water distribution systems servicing Deer Island and Nut Island. The task is also to use unit costs derived from the literature to assess the feasibility for reuse alternatives to reduce potable water demand. Current planning for water supply to the area will be investigated.

C. Plan Water Supply. Develop a plan for providing the required volume of water.

D. Estimate Telecommunications Needs. The purpose of this task is to characterize the telecommunications needs including telephone, radio, paging and alarm systems for Deer Island and

Nut Island during construction and operation. Coordination with the RMFP is required.

E. Characterize Telecommunications Capabilities. The purpose of this task is to determine the condition and capacity of existing telecommunication/transmission facilities for Deer Island and Nut Island.

F. Develop Telecommunications Plan. The purpose of this task is to identify the extent of telecommunications/transmission facilities which will be required for Deer Island and Nut Island and including requirements to relate these facilities to the entire MWRA sewerage system.

G. Define Security Criteria. The purpose of this task is to identify the criteria which will be used for development of the Deer Island and Nut Island security plan.

H. Develop Security Plan. The purpose of this task is to develop a security plan that details a program for controlling site access, and identifies options for fire and police protection.

I. Technical Memorandum. The purpose of this task is to prepare a technical memorandum for submittal to MWRA staff, for use in the facilities plan, and for preliminary design reports. The memorandum will include a complete discussion of all assumptions made, approaches taken, and results obtained.

II. TASKS AND ACTIVITIES

The tasks and activities associated with work package FO-38A include:

A. Examine existing studies and assess existing and planned electric power, heat, and transmission facilities at Deer Island. These studies include:

1. Deer Island Facilities Plan-Vol. 1 - Fast Track Improvements, Attachment Two, Appendix D, Havens & Emerson/Parsons Brinkerhoff, September 1983.

2. Deer Island Sewage Treatment Plant Power and Pump Station Improvements - Digester Gas Utilization and Sound Pressure Levels, Proposed 6,000 KW Diesel Engines at Deer Island, Havens & Emerson/Parsons Brinkerhoff, October 15, 1985.

3. Memorandum concerning fast-track program from Loretta Oi

to Steven Lipman, DEQE. Fast Track Improvements Impact on NO x, August, 1984 and subsequent correspondence.

4. Summaries of ambient air quality monitoring - Deer Island - by DEQE.

5. RMFP Scope of Services.

B. Determine Power Sources

1. Approximate power requirements for treatment and on-island sludge handling facilities for the years 2000 and 2020, and coordinate the needs assessment with theRMFP.

2. Provide these electrical power requirements to Boston Edison Company and obtain the following:

    a. Projected cost of electric energy
    b. Primary capacity
    c. Backup capacity
    d. Total construction cost and schedule for cable transmission. Schedule will include planning, environmental permitting and associated tasks.

3. Perform a preliminary air quality screening assessment to quantify the potential on-island electrical power generation which can be developed; and meet with DEQE to review results.

4. Summarize the availability and constraints of alternate power sources.

C. Preliminary Power, Heat, and Fuel Study - Deer Island

1. Estimate total, projected primary and backup power and heat requirements for treatment and on-island sludge handling facilities for the years 1991, 1995, 2000 and 2020, and coordinate the needs assessment with the RMFP.

2. Establish design criteria that will be used to develop and evaluate alternative plans.

3. Estimate supplemental fuel requirements based on previous studies/estimates of potential digester gas and residuals.

4. Evaluate preliminary cost and feasibility of alternative

plans.

5. Provide preliminary screening analysis of the air emissions for selected power generation/use alternatives.

6. Provide estimates for off-site fuel requirements, i.e., natural gas and/or distillate oil, determine method of delivery and associated cost and schedule.

7. Identify a recommended preliminary plan for providing primary and backup electrical power and heat requirements and feasible alternative plan(s) for subsequent detailed evaluation.

D. Technical Memorandum

1. Describe assumptions
2. Describe approach to identify a recommended plan
3. Describe results of the Preliminary Power, Heat and Fuel Study
4. Present a recommended preliminary plan for supporting site primary electrical power and backup needs, and a scope for the planned detail studies to be undertaken in Task E which follows.
5. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask E.

E. Finalize Power Heat and Fuel Systems

1. Identify significant energy consumers for both Deer Island and Nut Island; load duration and variation curves for electric, mechanical, and heating power will be developed; estimate annual and peak demand consumption.

2. Assess existing and planned (Interim Improvements) electric power, heat, and transmission facilities at Nut Island.

3. Develop capital and O&M cost estimates for each PHF alternative.

4. Develop annual loading factors for each PHF alternative and calculate principal annual inputs such as fuel, labor, and outputs such as power and heat sent to the treatment facility and possible export electric energy and power generation capacity sold to an electric utility.

5. Evaluate PHF alternatives for the Deer Island Facility and the Nut Island Facility.

6. Select the recommended Deer Island and Nut Island plan for primary and backup PHF.

7. Develop more detailed conceptual design, project schedule, and capital cost estimate input for the recommended PHF alternative.

8. Assess the feasibility of private third-party participation in the project: for instance a PURPA-qualified facility, owned and/or operated by a third-party, selling power and heat to MWRA.

The tasks and activities associated with work package FO-38B include:

A. Estimate Water Uses

1. Obtain construction site manpower projections and non-potable water requirements from WP FS-40B.

2. Obtain potable and non-potable operations water use requirements by use category from WP's 33A, 33B, 33C, 33D, and 34B, and from an RMFP estimate of on-island sludge facilities water needs.

3. Prepare an inventory of total potable and non-potable water use requirements for average and peak demand.

B. Estimate Telecommunications Needs

1. Obtain estimated telecommunications demand by user category based on manpower projections for construction and operation, and preliminary site layouts in WP's 31B, 32A, 33A, 33B, 33C, 33D, 33E, 34B, and 40B, and on potential on-island sludge operations from the RMFP.

C. Define Security Criteria

1. Obtain site population projections for construction and operation from various work packages and prepare a total site population projection by year.

2. Identify site access locations for construction and operation.

3. Coordinate with MWRA to identify criteria for site security planning.

D. Characterize Water Availability

1. Identify existing potable water supply capacity for Deer Island.

2. Consider current water supply planning for the area based on a previous study by Whitman & Howard and coordinate with MWRA.

3. Perform onsite inspection to assess the condition of potable water distribution.

E. Characterize Telecommunications/Transmission

1. Examine existing telecommunications transmission facility use for Deer Island and Nut Island.

2. Perform onsite inspection to assess the condition of telecommunications/transmission equipment.

F. Water Supply Plan

1. Prepare a site water use balance, indicating total potable and non-potable water uses, the quantities of potable and non-potable water provided by reuse/treatment, and the quantity of off-site supply required.

2. Determine feasibility and cost for offsite potable water supply by MWRA.

3. Select a water supply plan.

G. Develop Telecommunication Plan

1. Provide estimated offsite service requirements for telecommunications/transmission to telephone transmission service company to identify the following:

a. New telecommunications/transmission equipment from off-island.

b. Schedule and costs for transmission installation.

2. Identify potential mitigation measures for construction of transmission equipment.

H. Develop Security Plan

1. Identify security staffing requirements.

2. Describe security plan for controlling site access during construction and operation in accordance with criteria prepared in Task C.

I. Technical Memorandum

1. Discuss assumptions made
2. Describe approaches taken
3. Detail results
4. Present recommended water supply plan, telecommunications plan, and security plan.

III. WORK PACKAGE PRODUCTS

The work package products for FO-38A include:

1. A Power Sources memorandum which summarizes the availability and constraints of alternative power sources.

2. A preliminary Power, Heat, and Fuel Technical Memorandum which summarizes preliminary estimates of Deer Island electrical power, heat, and fuel needs, and evaluates alternative plans for providing primary and backup power, and a recommended plan.

3. A finalized plan and schedule for providing primary electrical power and backup power to Deer Island, Nut Island, Long Island and remote headworks facilities.

The work package products for FO-38B include:

1. A technical memorandum presenting potable and non-potable water needs, telecommunications needs, and security needs; an assessment of existing and required facilities to support site water, telecommunications, and security needs; and recommended plans for water supply, telecommunications, and security.

IV. REQUIRED WORK PACKAGE INPUTS

Inputs required to complete work package FO-38A include:

1. Conditions and capability of existing PHF facilities from WP DB- 20B.

2. Preliminary assessment of RMFP needs.

3. Various reliability, environmental, economic, financial, planning, and treatment facility technical information from other work packages used for conceptual design and evaluation of PHF alternatives.

4. Environmental evaluation of alternatives from WP 50B.

Inputs required to complete work package FO-38B include:

1. Various reliability and treatment facility technical information from other work packages used for conceptual design and evaluation of alternatives.

2. Estimate of RMFP on-island needs.

V. RESPONSIBILITY

Both work packages are under the direction of area manager Mr. William Callahan. They will be directed on the work group level by Mr. C. Anderson and Mr. A. Mills. Mr. C. Anderson is responsible for the technical execution of WP FO-38A; Bryant Associates and A.J. Mills are responsible for the technical execution of WP FO-38B.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 3

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FP-39 OPERATOR NEEDS

WORK PACKAGE: FP-39 A & B OPERATIONS AND MAINTENANCE REVIEW AND PRELIMINARY OPERATIONS PLAN

I. DESCRIPTION OF SCOPE

The purpose of this task is to identify the needs of the operations staff and to develop a preliminary operations plan. The needs iden- tification will provide the Authority with a foundation for estab- lishing personnel staffing levels, training needs, support functions and facilities. The conceptual preliminary plan of operations will enable the Authority to plan for events leading up to full operation of the facility. The scope of this work package is divided into six major subareas, as follows:

A. Establish a preliminary table of organization (TO) by preparing and reviewing a number of alternatives. Draft preliminary position descriptions will also be prepared and reviewed for those positions identified in the TO. The purpose of this task will be to identify employee needs based on a TO and provide discussion on personnel and facility requirements.

B. Identification of training needs, certification and licensing requirements will be presented for appropriate positions in the TO. This task encompasses the review and projection of what training is available, and what is not, to provide a well trained facility staff. The training will be identified in five categories.

1. Management
2. Supervisory

3. Laboratory/Sampling
4. Operations
5. Maintenance

Full use will be made of existing training programs available in the New England area before identification of requirements for new training program development to meet additional needs is undertaken.

C. Estimation of future facility needs will be developed for laboratory/sampling, personnel, safety, maintenance and shop including storage/inventory facilities as well as in-house training requirements. Estimates will include suggested space and area requirements, types of equipment and other considerations for effective performance of duties by related personnel as identified as part of Task A.

D. Determination will be made of the equipment or systems needed to support the operating staff of the facilities. These will include the type and number of vehicles. Communication system requirements within the facilities as well as those needed to coordinate activities with remote locations will be determined in WPFO38B - Other Utilities. Computer system requirements to maintain effective management of the maintenance and operations functions including hardware types and software needs. This information will be used to tie together the numerous operations, maintenance and management functions in the facilities.

E. Preparation of the preliminary plan of operation (conceptual only). This plan outlines the events that occur leading up to the full operation of the facilitywith emphasis on staffing needs.

F. Technical reports and memoranda. The purpose of this task is to present documentation of the work conducted under this work package including a summary of the operations review, needed support facilities and a preliminary design report of those facilities.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Establish the staffing criteria

1. Review the present table of organization (TO) and position descriptions

2. Discuss and review the present TO and position descriptions with MWRA operating staff
3. Review DEQE certification requirements
4. Prepare preliminary TO and position descriptions
5. Prepare personnel procurement strategy

B. Identify training needs and requirements

1. Identify training opportunities in New England area
2. Identify training requirements by staff position

    a. Management
    b. Supervisory
    c. Laboratory/Sampling
    d. Operations
    e. Maintenance

3. Discuss and review requirements and opportunities with MWRA operating staff
4. Identify training needs not presently available and alternatives for obtaining
5. Prepare a memorandum on training needs

C. Estimate facility needs

1. Review existing facilities for future use as identified in Task C above
2. Discuss needs with MWRA operating staff
3. Identify needed facilities
4. Discuss needs with DEQE and other agencies as required
5. Establish space requirements
6. Identify preliminary major equipment items
7. Review identified requirements with MWRA operating staff
8. Coordinate with RMFP and IPP staff and consultants

D. Determine support systems and equipment

1. Review existing support systems and equipment for future use
2. Discuss support systems and equipment requirements with MWRA operating staff
3. Identify and outline the support systems and equipment identified in Task D above.
4. Review outlines with MWRA operating staff

E. Prepare the preliminary plan of operation (conceptual)

1. Draft the conceptual plan of operation
2. Review the draft plan with other project activity groups
3. Review the plan with MWRA operating staff
4. Modify as required

F. Prepare memorandum and reports

1. Prepare memorandum on certification requirements
2. Prepare memorandum on training opportunities in New England
3. Prepare a report on facility and major equipment needs
4. Prepare a report on support systems and equipment needs
5. Prepare preliminary plan of operation

III. WORK PACKAGE PRODUCTS

The work package products include:

1. Memo on certification requirements
2. Preliminary TO and position descriptions
3. Memo on training opportunities
4. Memo on training needs and alternatives
5. Report on facility and major equipment needs
6. Report on support systems including size and locations, and equipment needs
7. Preliminary plan of operation
8. Memo on operations review

IV. REQUIRED WORK PACKAGE INPUTS

Inputs required to complete this work package include:

1. Information from MWRA operating personnel
2. Information from DEQE
3. Information from numerous training programs
4. Reports and other information collected under FB20, FC30, FD31, FE32, FF33, FS40

V. RESPONSIBILITY

This task is conducted by CDM under the direction of William Callahan, Manager of Facilities Engineering assisted by William R. Hill.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 4

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FS-40 CONSTRUCTION CONSIDERATIONS

WORK PACKAGE: FS-40A EXISTING PLANT OPERATIONS

I. DESCRIPTION OF SCOPE

The scope of this work package is to outline the operation of the existing plants' requirements to continue the operation of the existing plants during the construction period.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Outlining the present operation of the existing Deer and Nut Island plants and headworks. The outline will consist of a schematic of the present plants operation, accompanied by a listing of unit processes by number and size. The outline will include the influent and effluent wastewater conduits, major utilities, and sludge piping location and capacities.

B. Preliminary plan for the Maintenance of Plant Operation during Construction (MOPO). The MOPO would be coordinated with the draft implementation schedule in WP PT-70B. The preliminary MOPO would outline the transition from existing to new facilities by identification of the type and number of existing and new unit processes in operation as a function of time. The preliminary MOPO will incorporate considerations of discharge permit compliance, plant access, mitigation requirements, and interim facilities if needed.

C. The preliminary MOPO will be accompanied by a preliminary schedule of materials and construction techniques that will be necessary to ensure that the new facilities are protected

during construction and subsequent operations. Emphasis will be to ensure that the long term integrity and aesthetics of the new treatment plant are maintained, based on the climatological conditions (moist ocean environment), wastewater characteristics, the selected process and the environmental conditions of the MWRA's Deer Island site. The preliminary schedule of materials will be prepared with consideration and emphasis on those materials that will provide both longevity and ease of maintenance.

III. WORK PACKAGE PRODUCTS

The work package products include:

A. An outline of existing plants operation
B. Preliminary plan for the Maintenance of Plant Operation (MOPO)
C. Preliminary schedule of materials and construction techniques

IV. REQUIRED INPUTS

Inputs required to complete this work package include:

- Draft implementation schedule from WP PT-70B
- Requirements for the O&M of existing facilities

V. RESPONSIBILITY

Mr. Stephen Rafferty is responsible for the execution of this work package. The work group leader is Mr. Andy Mills, under the direction of area manager Mr. William Callahan.

Approved: _____
MWRA

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CDM/S&W
Date: _____
Rev: 5

WORK SUMMARY: F - FACILITIES ENGINEERING

WORK GROUP: FS-40 CONSTRUCTION CONSIDERATIONS

WORK PACKAGE: FS-40B CONSTRUCTION PLANNING

I. DESCRIPTION OF SCOPE

The scope of this work package is to provide preconstruction planning for the interisland transport system, the secondary treatment facilities, and the outfall which will identify construction methods and techniques, minimize construction duration and construction-related environmental impacts, and recommend a construction program including construction sequencing and the defining of Contract Design packages.

The scope of this work package is divided into the following subareas:

A. Site Preparation Plan. The purpose of this task is to provide a preliminary assessment of the construction activities which can be implemented prior to and immediately after construction of piers at Deer Island, and to prepare a Preliminary Design Report on Site Preparation. Major site preparation aspects included in this task are drumlin relocation/disposal, building demolition debris disposal, and excavation/disposal of the contents of the grit and screening dump. This task will incorporate protection of historic buildings and sites into the site preparation planning.

B. Evaluation of the Constructibility of Alternatives. The purpose of this task is to perform a constructibility review of the alternative process trains (WP FJ-36A) and alternative interisland transport conduit and ocean outfall plans (Work Group FG-34). The constructibility review identifies special construction techniques required, preliminary construction schedules, etc., as input for

the screening and detailed evaluation of alternative plans; this constructibility review is summarized in a technical memorandum.

C. Preliminary Construction Plan. The purpose of this task is to refine the preliminary constructibility review for the selected secondary facilities, identify plans for construction sequencing, and assess alternative scheduling and construction techniques which will minimize the overall schedule.

D. Technical Memorandum. The purpose of this task is to prepare a technical memorandum which describes the preliminary construction plan, schedule, comparison with the Federal Court target dates, and Contracts/Design packages.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Site Preparation Plan

1. Based on previous studies in the Siting FEIR/FEIS, develop preliminary estimates of spoil quantities for the drumlin, building demolition, and grit and screenings dump.

2. Evaluate on-land and ocean disposal/use options for drumlin spoil and building demolition debris.

3. Develop preliminary schedules for site preparation activities.

4. Evaluate any special construction needs such as site dewatering including handling of contaminated groundwater, and provide their implementation in the site preparation plan.

5. Locate preliminary materials storage/laydown areas.

6. Coordinate with the environmental evaluations for noise, dust emissions and site erosion (WP-50E), and integrate the recommended mitigation measures in the site preparation plan.

7. Prepare the Preliminary Design report for Site Preparation. The report will summarize the recommended site preparation plan, and describe the early site preparation procedures, recommendations for spoil, disposal/use, special

construction needs and environmental mitigation measures.

B. Evaluation of the Constructibility of Alternatives

1. Summarize alternative process train concepts (WP FJ-36A) and alternative interisland transport conduit and ocean outfall plans (Work Group FG-34).

2. Develop construction methods and preliminary construction schedules for each alternative.

3. Assist each of the work group leaders in developing preliminary cost estimates for alternative process trains and transport needs, and a preliminary construction schedule.

4. Prepare a technical memorandum for use in the coarse screening of alternatives, which summarizes special construction needs, and a preliminary construction schedule.

C. Construction Plan

1. Based on the preliminary construction technical memorandum for the selected secondary facilities, develop a construction plan which incorporates the activities below.

2. Identify major salvageable equipment by performing onsite inspection, and coordinating with work group leaders for FF-33 (Unit Process Evaluation) and FG-34 (Transport System Evaluation).

3. Recommend, as appropriate, innovative construction methods and techniques that can be implemented in the final design.

4. Coordinate with work package FO-38B in developing site access/security plans for construction.

5. Assist the Work Package FF-33G leader and the Work Group EL-50 and EK-51 leader in identifying and evaluating potential trial construction impacts and recommending mitigation measures.

6. Coordinate with equipment/facilities specialists to identify the general support and specialized equipment needed for construction.

7. Refine preliminary plant construction schedules, and identify construction packages for sequenced implementation.

8. Describe the number and type of Contracts/Design packages required for input to WP 70B.

9. Provide an assessment of the efficiency and cost effectiveness of using construction management techniques for the recommended construction program.

D. Technical Memorandum - Construction Plan

1. Prepare a technical memorandum which describes the construction plan for the secondary treatment facilities. The technical memorandum will summarize the recommendations for construction schedule.

III. WORK PACKAGE PRODUCTS

1. Preliminary Design Report - Site Preparation
2. Technical Memorandum - Evaluation of the Constructibility of Alternatives
3. Technical Memorandum - Construction Plan

IV. REQUIRED WORK PACKAGE INPUTS

Inputs required for the execution and completion of this work package include:

1. Alternative site arrangements, process train concepts, and interisland transport conduit and outfall.

2. Mitigation plans for WP EI-50E, including consideration for protection of historic buildings/sites.

3. Geotechnical information concerning marine subsurface conditions which are characterized in WP FH-35B.

4. Court target construction dates.

V. RESPONSIBILITY

This work package falls under facilities planning which is directed by area manager W.F. Callahan. The work group (FS-40) is directed by A. Mills. Mr. R. Cusick and D.M. Carson Inc. are responsible for work package direction and technical products.

APPROVED: _____
CDM/S&W

_____
MWRA

DATE: _____

REV.: 3

WORK SUMMARY: E - ENVIRONMENTAL

WORK GROUP: EI 50 - ENVIRONMENTAL REVIEW

WORK PACKAGE: 50A - EXISTING LAND/AIR ENVIRONMENT
50B - EXISTING MARINE ENVIRONMENT
50C - ENVIRONMENTAL EVALUATION OF ALTERNATIVES
50D - ENVIRONMENTAL EVALUATION OF RECOMMENDED PLAN
50E - MITIGATION PLAN
50F - AGENCY COORDINATION
50G - ENVIRONMENTAL DOCUMENTS

I. DESCRIPTION OF SCOPE

The scope of this group of work packages includes the collection and analysis/synthesis of environmental data necessary to establish the baseline land, air and marine related environmental conditions in the vicinity of Deer Island, Nut Island, a portion of Long Island, and the headworks. Field data collection programs will be used, as necessary, to expand the data base. These data will be used for the assessment of impacts due to the construction and operation of the treatment plant for alternative and recommended designs. The final product is the EID. Final scopes and budgets will be developed based upon later agency scoping sessions.

The scope of this work package is currently divided into the following major subareas:

A. Existing Land/Air Environment - Collect, analyze and synthesize environmental data describing existing conditions which are necessary to address land and air related environmental impacts associated with plant construction and oper-ation and on-island disposal of excavation and tunnel spoils. Subject areas include: cultural resources (including archeological and historic resources); flood plain and wetlands; agricultural lands; coastal zones; wildlife; endangered species; air quality; (including odors

and aerosols); noise; visual aesthetics; land use (including areas potentially affected by the use of buses and barges to transport workers, equipment, and supplies to Deer Island); recreational opportunities; and groundwater hydrology. The land/air environmental baseline will assume the existence of Deer Island and Nut Island water transportation facilities which are being planned in EDEA project no. 5939 (as amended by the Notice of Project Change, July 31, 1986). Specific activities include:

1. Existing Data - Collect, analyze and synthesize existing environmental data necessary to address land and air-related environmental impacts.
2. Field Data - Prepare and implement plans of study for the land and air field data collection programs that are necessary to provide an adequate data base. Preliminary programs are currently included for noise, archaeology, historic resources, and wastewater quality characterization as it relates to air emissions. The plans of study for field data acquisition will account for environmental baseline effects which are attributable to ongoing Fast-Track construction. Additional programs or changes to the programs described may be recommended depending on the adequacy of existing data. The field data collection and analysis programs which are expected to be executed include:

    a. Ambient Noise Survey - Noise surveys will be conducted in both the Deer Island and Nut Island vicinities. Specific monitoring locations will be selected during the preparation of the detailed sampling protocol. Ambient sound levels will be monitored 24 hours per day for approximately 7 days and nights at two critical monitoring locations. Short-term A-weighted statistics and residual octave band sound level measurements will be collected manually at the continuous monitoring locations, and at 3 to 6 additional locations on approximately three of these 7 days and nights. The noise survey plan of study will be provided to DEQE for their review/approval.

    b. Archaeologic Survey - A two-phase archaeologic survey will, as necessary, be conducted at Deer Island of the historic cemetery discovered during a previous reconnaissance survey within the Deer Island project area. The archeologic survey has been reviewed by the Massachusetts Historical Commission, and is an extension of work begun for the siting FEIR. The first phase of the archeologic study will be performed

to document the age of the cemetery; a technical memorandum summarizing the first phase results and recommendations for a second phase study will be provided to the State Historic Preservation Office. If the first phase indicates that the cemetery is older than 100 years, a site verification phase study will be performed which will include soil resistivity measurements to locate burials, and subsurface testing to verify the presence of human skeletal remains. All work will be performed in compliance with Section 106 of the National Historic Preservation Act.

c. Historic Resources Survey - The Massachusetts Historical Commission has determined that the Deer Island Pumping Station Complex and two buildings within the Deer Island Prison meet criteria of eligibility for listing in the National Register. Should the site planning work performed in work package FD 31B indicate that construction of secondary treatment facilities at Deer Island are incompatible with the preservation of these structures, the only feasible alternative which would preserve these structures would be to locate secondary treatment facilities at Long Island. Accordingly, an historic structure survey would be performed on Long Island to document whether historic structures which meet criteria for listing in the National Register also exist there. This additional survey would be performed only if site planning work for Deer Island indicates that removal of existing Deer Island historic structures is required for construction of secondary waste water treatment facilities. Costs for an assumed historical survey have been included. The historic survey will be performed in compliance with Section 106 of the National Historic Preservation Act.

d. Wastewater Characterization Survey for Air Quality Assessment - Additional sampling may be required as a part of the environmental review to supplement the program to be conducted in the Spring under WP FB 20C and will be necessitated based on a review with DEQE of the results of Fall sampling under WP FB 20C. Examples of findings which will trigger the additional sampling include: 1) identification and order of magnitude quantification of approximately 20 additional peaks which represent constituents at concentrations of significant concern to DEQE as air

toxics; and/or 2) influent/effluent VOC concentrations in the waste stream at the remote headworks, which in conjunction with shaft air sampling, do not provide a realistic assessment of VOC emissions from the headworks. Additional sampling needs are budgeted herein to include the following possible elements to supplement the Spring program under WP FB 20C:

- Quantification of up to 20 additional peaks for the Nut Island and Deer Island influent samples collected under WP FB 20C. Quantification of 20 constituents has been assumed for budgetary estimating purposes; the actual number of constituents which will be quantified will be determined after review of the fall waste water sampling results.

- 24 hour composite samples of influent at the three remote headworks for priority pollutants/ hazardous substances list and identification/ quantification of up to 20 additional peaks (4/day for 5 days).

- Grab VOC samples of the influent and efficient at the three remote headworks (4/day for 5 days).

- Air sampling at the headworks at three locations including the effluent shaft.

- Grab VOC samples of the effluent from Deer Island and Nut Island or some intermediate waste stream location on each site (4/day for 5 days) (For influent sampling, see WP FB 20C).

B. Existing Marine Environment - The purpose of this work package is to acquire from available informa-tion and implementation of specifically designed field data col-lec-tions, sufficient data on physical oceanography, local water quality and marine ecology to describe the existing marine environment in the planning area as related to the evaluation of alternative and selection of the proposed project. The results will provide the basis for projection of the future environment without the project, development as well as evaluation of alternatives, evaluation of the nature and extent of impacts, and development of necessary mitigation measures. The proposed program will focus on defining local resources, environmentally sensitive features, and general

environmental productivity in order to effectively consider these issues in describing impacts of the selected plan.

The following tasks are included in this work package:

1. Existing Data - Collect, evaluate and synthesize existing environmental data pertinent to the Boston Harbor/offshore ecosystem. These data will be used to the extent possible to define the environment and to address marine related impacts of the alternatives and recommended plan. Where data are judged to be insufficient for these purposes, original field research in areas directly impacted by project construction or operation will be considered.

2. Field Data - Prepare and implement plans of study for marine field data collection programs that are defined in the existing data evaluation as necessary to provide an adequate data base.

Plans of study will be prepared to describe the parameters to be sampled, the means of sampling, station locations, frequency, etc., in sufficient detail to ensure valid data which can effectively serve project needs. A preliminary plan of study for marine ecology and water quality has been prepared subsequent to and in consideration of preliminary evaluations under WP FG34D - Outfall Site Selection. These considerations are reflected in the number and placement of sampling location and the number of stations sampled over time. Preliminary results from WP FG34C are reflected in the assumption to consider only tunneling for the interisland transport conduit and from Deer Island to the outfall.

Based on input from WP FG34D, sampling would take place in five areas under consideration for the outfall site (see attached figure). The locations include: the existing Deer Island outfall (the no-action alternative); an area SE of Nahant in 100' of water near the 301(h) site; an area in Central Broad Sound in 45' of water; an area in Broad Sound between the channels from Presidents Roads; and an area east and south of the island chain which extends from the mount of the harbor. These locations correspond to areas presently being considered in physical oceanographic surveys and represent a range of depths (i.e., potential dilution factor) and locations which appear to be feasible.

Sampling is assumed to be initiated in the fall and conducted at five outfall sites for two seasons. For the third season, sampling would take place at only sour sites, assuming that one location would no longer be considered feasible. Concurrent sampling at all feasible sites is needed to provide an adequate description of the currently existing environment and technically comparable data to evaluate alternative outfall sites. Year-to-year biological variation, the limited scope and time frame of previous collections and/or differing collection methods preclude use of data obtained earlier at the 301(b) and current outfall locations for these purposes.

It is assumed that sampling should continue at all feasible outfall locations until a full year of data has been collected (although only nine months of sampling is included under this work package). This will provide an adequate current information base for outfall site selection and impact assessment; it will also avoid seasonal problems of biology associated with a program with a program initiated in the fall.

Parameters which may be sampled for marine ecology/water quality include water quality, sediment characteristics, sediment chemistry, toxicity, phytoplankton, meroplankton, fish, macroinvertebrates, submerged vegetation, epifauna and benthic infauna. Biological sampling will be basically seasonal for three seasons with some variation in frequency for selected parameters. Sampling will initially focus on five outfall sites for two seasons, and will then be reduced for the third season to sampling at one site as recommended by the second phase of the physical oceanography program. Based on preliminary geotechnical reviews in WP FG 34C and the COE's precluding of trenching in major channels, the sampling program assumes that the NI to DI conduit and southern conduit route alternative will be constructed as tunnels.

Physical oceanographic collections would be conducted concurrently with biological sampling for six months. Parameters to be sampled include current speed and direction, water quality, bottom topography, and tidal variation. Meters deployed will produce continuous records of local conditions in an area encompassing all outfall sites being considered. The results of the sampling will confirm preliminary site selection under WP FG34D, Outfall Site Selection and will also provide input to environmental

characterization and impact assessments required for the EID.

After selection of an outfall location (WP FG 34D and WP EI 50B) and discharge transport mode (WP FG 34E), marine ecology sampling may be continued in the pertinent locations during the EIR effort to provide more detailed information for impact assessment. This sampling will be limited to an additional annual quarter.

The detailed selection and evaluation of marine ultimate disposal sites for excavation and tunnel spoils are not included in the present work package scope or reflected in the current plans of study. The budgeted studies include an assessment of the feasibility of marine disposal of these materials; additional field data collection would be added to scope if marine disposal of excavation materials is determined to be required.

C. Environmental Evaluation of Alternatives - Assess potential environmental impacts associated with the alternative designs for the secondary treatment facilities including headworks, the inter-island transport conduit, and the outfall. Areas included in this assessment are cultural resources, flood plains and wetlands, agricultural lands, coastal zones, fish and wildlife, endangered species, air quality, water quality and uses, noise, odor, aesthetics, land use (including any necessary updating of transportation impacts which were assessed by the off-island water transportation project), energy requirements, and recreational opportunity. This scope also includes the development of environmental criteria which will be used in the facilities engineering tasks for preliminary screening and evaluation of alternative concepts. Specific studies will be performed for air emissions analysis, alternative disinfection methodologies and chemfix treatment of grit and screenings to address these concerns.

1. The air emissions evaluation will include a preliminary identification and quantification based on the Fall sampling program in WP FB 20C of additional constituents in the wastewater which could become airborne emissions and be classified as ozone precursors and/or toxics. A preliminary assessment will be made of whether such emissions exceed State Acceptable Ambient Levels (AAL). DEQE will develop AALs for coastewater constituents not presently listed, depending on the results of the Fall, 1986 wastewater sampling program.

Based on influent and effluent wastewater quality field data, organic acid production rates, and available literature on

volatilization, a procedure will then be developed to estimate emissions from the headworks and plant locations for the various phases of the project. The potentially toxic component of the emissions will be identified.

The need and level for emissions controls will be evaluated. Dispersion modelling will then be used to assess the worst case impact of emissions on ambient air quality. The calculated impact will be prorated for each identified potential toxic and/or organic precursor. These prorated levels will be compared to State AALs. The top 20 identified constituents will then be quantified in the Spring sampling program for a more intensive evaluation of impacts and controls.

2. The relative toxicities of three disinfection methods, chlorination, chlorination/dechlorination and ozonation, will be evaluated for combined effluents from Nut Island and Deer Island. This testing is necessary to assess the impacts that each disinfection method will have on the environment.

The testing will include bench-scale primary and secondary treatment on two different combined samples from Nut Island and Deer Island to obtain an effluent similar to that expected from the full scale plant. Four aliquots will be collected from the finished water from each test and disinfected using one of the three types described above and one undisinfected control. The parameters such as dosage and contact time for each method will be determined in the engineering phase of the disinfection evaluation package and used in this study. Following the appropriate contact time, a one gallon sample from each disinfection method will be analyzed using standard bio-toxicity testing with mysid shrimp.

3. To assess an alternative method for disposing of the materials contained within the grit and screenings dump currently located on Deer Island, chemfix treatment will be evaluated. Chemfix testing will be performed on representative samples removed from the grit and screenings dump to determine the feasibility of this process for stabilizing the grit and screenings. Tests performed on the chemfix samples will include EP-toxicity analyses of the leachate. The results of this testing will be incorporated into the site preparation plan to be developed in work package FS40B.

4. Work Package FD 38A includes the preparation of a Preliminary Power Needs Study, which will determine the source (i.e.

on-island or off-island) for providing electrical power required by the new wastewater treatment plant. Depending on the results of this study, a field data collection effort may be added herein to assess the environmental impacts associated with off-island power supply. This additional work is not currently included in budget.

D. Environmental Evaluation of Recommended Plan - In accordance with the regulations contained in 40CFR part 35, predict changes to the environmental baseline associated with the recommended plans for construction and operation of the treatment plant facilities, interisland transport conduit and outfall. Assess and describe the resultant beneficial and adverse environmental impacts for each environmental discipline. Verify the environmental suitability of the recommended facility designs.

E. Mitigation Plan - Determine implementation requirements to achieve MWRA mitigation commitments and respond to other agency and public concerns as well as any mitigation measures assumed to be part of the selection process for recommended alternatives. Refine, as necessary, the measures which will be used to mitigate environmental impacts associated with the site plan (work package FD31B and FE32A), construction and operation of the treatment plant facilities, inter-island transport conduit and outfall. Prepare a mitigation plan to ensure that mitigation measures are documented and implemented.

F. Agency Coordination - Establish and participate in an agency/ community review mechanism throughout the project to facilitate the process of scoping the EID and the Environmental Impact Report (EIR), and reviewing the subsequent products.

G. Environmental Documents - Prepare the EID and ENF required to obtain federal and state approval for the treatment plant facilities, interisland transport conduit and outfall.

II. WORK GROUP PRODUCTS

The products of this work group include:

1. Field survey protocols for field data collection.
2. Field data reports.
3. Technical memoranda describing existing conditions, environmental criteria for screening and evaluating alternatives and recommended facilities, environmental impact assessments, potential mitigation measures, air quality impact assessments and chlorination reduction recommendations.
4. Mitigation plan.
5. Completed ENF.
6. Scope documents for EIR and EID.
7. Draft and final EIDs.

III. REQUIRED WORK GROUP INPUTS

A. Previous studies, regulatory documents and background data

B. Wastewater sampling results from WP FB 20C

C. Applicable rules and regulations from WP IN 62A

D. Agency and community concerns/issues from WP IL 60A

E. Preliminary engineering designs, facility arrangements and construction activities from Work Groups FD31, FE32, FF33, FG34, FJ36, FO38, and FS40 F. MWRA mitigation commitments

G. Pier Facilities Plan, including environmental impact evaluation of barge traffic.

H. Permitting requirements and preliminary implementation schedule from WP's IN 62B and PT 70B.

IV. RESPONSIBILITY

Ms. Jean L. McCluskey is responsible as Area Manager for overall direction of the environmental tasks; Mr. Andrew J. Mills is Technical Manager for the environmental tasks. The individuals who are responsible for the execution of each task are as follows:

Work Package	Work Package Engineer/Scientist
Existing Land/Air Environment	A.J. Mills
Existing Marine Environment	T.A. Biffar
Environmental Evaluation of Alternatives	A.J. Mills
Environmental Evaluation of Recommended Plan	A.J. Mills
Mitigation Plan	D.G. Tuttle
Agency Coordination	J.L. McCluskey
Environmental Documents	A.J. Mills

Approved: _____

MWRA

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CDM/S&W

Date: _____

Rev: 2

WORK SUMMARY: I - INSTITUTIONAL

WORK GROUP: IL 60 - PUBLIC PARTICIPATION

WORK PACKAGEIL 60A - PUBLIC PARTICIPATION

I. INTRODUCTION

In keeping with the magnitude and importance of the 24 month Secondary Facilities Plan project a full scale public participation program will be conducted. The goals of this program, coordinated with the MWRA Public Affairs Office and the MWRA Engineering staff are:

* Maximize public input
* Assure a constant flow of information
* Promote and maintain sensitivity to impacted communities
* Coordinate with other ongoing and related projects

II. DESCRIPTION OF SCOPE

The scope of work of this package is to conduct a program to inform and involve the public in the progress of the study, alternatives being considered, and conclusions reached and to solicit their comments and suggestions. In concert with MEPA and DEQE a Citizen's Advisory Committee will be formed to provide input to the Authority on the conduct of this study. In addition to regular meetings with the CAC, other MWRA committees, and neighborhoods, public information materials and education programs will be developed for groups with special local interests. Examples of the special local interest include the citizens of the Town of Winthrop and of the Cities of Boston and Quincy, and other groups with particular interest in the social, environmental and economic impacts of this project.

III. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Formulate Program

1. Develop the public participation plan for approval.
2. Assist in formulation of Citizen's Advisory Committee and in identifying key local interest groups.

B. Conduct Meetings and Hearings

1. Prepare for and attend 6 briefings of the Authority staff.
2. Prepare for and attend up to 24 monthly meetings with the EIR CAC.
3. Conduct periodic public information meetings (including 36 formal and informal meetings).
4. Conduct three workshop sessions with the CAC
5. Conduct 3 public hearings on the draft Facilities Plan and EIR
6. Provide speakers for up to 10 "special request" meetings of local organizations and clubs
7. Schedule and coordinate meetings including

    a. Locate, reserve and set up meetings places;
    b. Prepare handouts and materials for meetings;
    c. Prepare and place advertisements of meeting date, location and time for newspapers, publications and posters
    d. Prepare attendance sheet and minutes

C. Establish Information Transfer and Develop Information Materials

1. Establish and maintain repositories
2. Establish and maintain mailing lists
3. Prepare with MWRA Public Affairs staff and distribute a quarterly newsletter
4. Assist MWRA with the preparation and development of public affairs announcements for radio, television and newspapers
5. Develop an educational display for use by the Authority
6. Develop brochures for pick-up at public repositories
7. Assist MWRA with community information centers
8. Prepare a responsiveness summary for public information

meetings and transcript of responsiveness summary for all public hearings for distribution to project team and the public

9. Prepare an overall summary of public participation efforts and their effectiveness for inclusion in final report

IV. WORK PACKAGE PRODUCTS

The work package products include:

* Public Participation Plan
* Handouts for Meetings
* Advertisements for Meetings
* Project Briefing Papers for MWRA Public Affairs staff
* Mailing lists
* Newsletter
* Announcements for Media
* Educational Display
* Brochures
* Responsiveness Summaries
* Overall Summary

V. REQUIRED INPUTS

The inputs required to complete this work package include:

* Text from Work Package Leaders describing progress of study and presenting technical information.

VI. RESPONSIBILITY

This task will be undertaken under the leadership of Regina Villa, reporting to John Gall.

c. Individual community studies

5. Contribution from CSO's

   a. "Old" CSO study
   b. New MWRA CSO work

6. Local community sewage plans

   a. Community facilities plans completed/in progress

7. Septage loading estimates

   a. MWRA setpage studies
   b. MWRA septage records/reports

8. Assessment of MWRA data

   a. Nut Island operating records
   b. Deer Island operating records
   c. Headworks records
   d. Integrate sampling program data

9. Develop variabilities of flow and loads

   a. Deer Island
   b. Deer Island headworks
   c. Nut Island

10. Estimate variability factors for future use

11. Estimate sensitivity of flow/loads

   a. To pricing strategies
   b. To regulatory strategies (pretreatment limits)
   c. To changes in economic/demographics

12. Review data relevant to toxicant contributions

   a. Plant operating records
   b. IPP records
   c. Trend analyses/waiver reports
   d. Other relevant studies

      i. EPA 40 cities
      ii. Metro Seattle TPPS

iii. Other

e. Integrate sampling program data

C. Develop estimates of future flow and loadings

1. Extrapolate future flows from data in B

a. Estimate base condition
b. Conduct sensitivity analysis based on

i. Service area modifications
ii. Variables identified in II K

c. Estimate critical time dependant variables

i. Peak hour
ii. Maximum day
iii. Maximum month
iv. Average day
v. Minimum day
vi. Minimum hour

2. Extrapolate future conventional pollutant loads from data in B

a. Estimate base condition
b. Conduct sensitivity analysis based on

i. Service area modifications
ii. Variables identified in B 11

c. Estimate critical time dependant variables

i. Maximum day
ii. Maximum month
iii. Design day
iv. Average day
v. Minimum month

3. Estimate future toxicant concentrations

a. Develop estimates of domestic concentrations
b. Develop estimates of nondomestic concentrations

D. Segregate flow and load estimates by headworks

1. Subdivide system into headworks service areas
2. Subdivide flow and load projections into headworks service areas
3. Estimate flows and loads by headworks
4. Integrate sampling data into headworks estimates

E. Prepare technical memoranda and reports

1. Prepare preliminary report on findings and methodologies of the flow and load task
2. Prepare technical memoranda on waste characterization
3. Modify as necessary to incorporate sampling program data
4. Prepare documentation for spreadsheets used as part of task

III. WORK PACKAGE PRODUCTS

A. Memorandum on proposed planning area
B. Preliminary report on findings and methodologies of the flow and load task
C. Memorandum on waste characterization
D. Final report incorporating sampling program data and reviews
E. Documentation for spreadsheets used as part of task

IV. REQUIRED INPUTS

A. Flow metering and sampling data from FB 20C, influent flow metering and sampling
B. Reports and other information collected under MA 01D

V. RESPONSIBILITY

This task is conducted by CDM under the direction of John Gall, Area Manager of Institutional Analyses.

Approved: _____
MWRA

_____
CDM/S&W

Date: _____

Rev: 4

WORK SUMMARY: I - INSTITUTIONAL
WORK GROUP: IC-63B FLOW AND PERFORMANCE/REMOVAL CRITERIA
WORK PACKAGE: IC-63B PERFORMANCE/REMOVAL CRITERIA

I. DESCRIPTION OF SCOPE

The scope of this work package is to develop performance/removal criteria (concentrations, percentage removal, lbs/day discharged) for conventional and other-than-conventional pollutants that the Deer Island Plant will have to meet during dry and wet weather conditions. Two or three discharge scenarios relating to performance/removal criteria will be identified for conventional pollutants, during dry weather conditions, for input into the unit process and alternative treatment evaluations and for use in the outfall discharge site selection. Performance/removal criteria (estimated effluent concentrations) for other-than-conventional pollutants during dry and wet weather conditions and for conventional pollutants during wet weather conditions will also be developed for alternative treatment process. The performance/removal criteria will be used to balance the level of treatment required and outfall location. Final selection will be done under Work Package FJ36A.

The scope of this work package is divided into four major sub areas as follows:

A. Collect and review existing information. The purpose of this task is to review available data on flows, loads, removals, state water quality standards, NPDES requirements and pertinent MWRA mitigation measures.

B. Establish performance/removal criteria for conventional pollutants. The purpose of this task is to develop performance/removal criteria for primary and secondary portions of the treatment facilities for conventional pollutants (BOD, TSS, pH, coliforms, settleable solids, residual chlorine, oil and grease) during average and peak dry weather conditions.

C. Establish performance/removal criteria for conventional pollutants for primary and secondary portions of the treatment facilities during wet weather conditions and for other-than-conventional pollutants (non-conventional and toxic) for dry and wet weather conditions. The purpose of this task is to develop performance/removal criteria for conventional pollutants (BOD, TSS, pH, coliforms, settleable solids, residual chlorine, oil and grease) during wet weather conditions. This task will also develop performance/removal criteria as appropriate for other-than-conventional pollutants including non-conventional pollutants (NH_3 and P) and toxic pollutants (priority pollutants), during dry and wet weather conditions. The performance/removal criteria for conventional pollutants during wet weather conditions and for other-than-conventional pollutants during both wet and dry weather conditions will be selected by balancing the level of treatment required and the outfall location.

D. Preparation of interim report. The purpose of this task is the documentation of the work produced.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Collect and Review Existing Information

1. Review state water quality requirements
2. Review NPDES requirements
3. Review MWRA mitigation agreements
4. Review existing flows and influent characteristics (conventional and other-than-conventional pollutants) to the Deer Island and Nut Island Plants
5. Review data on current removal rates at the existing plants

B-1. Develop Draft Performance/Removal Criteria-Conventional Pollutants (Dry Weather)

1. Define dry weather flow conditions using the preliminary projections of flows and loads (Work Package IC-63A)

2. Develop draft performance/removal criteria for conventional pollutants (BOD, TSS, pH, coliforms, settleable solids, residual chlorine, oil and grease) for

primary and secondary portions of the treatment facilities' dry weather conditions.

B-2. Review Draft Performance/Removal Criteria-Conventional Pollutants (Dry Weather)

1. Review final results of the sampling program (WP FB-20C)
2. Incorporate final results of the flows and loading analysis (Work Package IC-63A)
3. Submit proposed criteria to MWRA for review
4. Incorporate MWRA comments
5. Review revised criteria with state and federal regulatory agencies

B-3. Develop Final Performance/Removal Criteria-Conventional Pollutants (Dry Weather)

1. Incorporate results of federal and state regulatory agency reviews
2. Develop final performance/removal criteria for conventional parameters for dry weather flows

C-1. Develop Estimated Influent Concentrations of Conventional Pollutants (Wet Weather) and Other-Than-Conventional Pollutants (Wet and Dry Weather)

1. Define wet weather flow conditions using the preliminary projections of flows and loads (Work Package IC-63A)

2. Develop envelope estimations of the levels of conventional pollutants expected in the influent, during wet weather periods and the levels of other-than-conventional pollutants expected in the influent during wet and dry weather periods

C-2. Develop Draft Performance/Removal Criteria for Conventional Pollutants (Wet Weather) and Other-Than-Conventional Pollutants (Wet and Dry Weather) for Primary and Secondary Portions of the Treatment Facilities

1. Review results of the outfall siting analysis
2. Develop draft performance/removal criteria for conventional pollutants during wet weather conditions
3. Develop draft performance/removal criteria for other-than-conventional pollutants during both wet and dry weather conditions

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 4

WORK SUMMARY: P - RECOMMENDED PLAN

WORK GROUP: PT-70 RECOMMENDED PLAN

WORK PACKAGE: PT-70A FACILITIES PLAN

I. DESCRIPTION OF SCOPE

The scope of this work package is preparation of the Facilities Plan. It includes assembling the recommendations from engineering, environmental and institutional work packages into a coherent and comprehensive Facilities Plan Report.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Prepare Report Outline and Format

1. Prepare a detailed outline of the complete Secondary Treatment Facilities Plan report

2. Submit the outline to MWRA for review and comment

3. Prepare a draft project administrative directive (PAD) describing the standard formats to be used for report text, figures and tables

4. Submit the draft to MWRA for review and comment

5. Publish a final PAD describing standard formats

6. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask B.

B. Complete the Facilities Plan

1. Assemble parts of recommendations into a coherent whole facilities plan

2. Obtain capital and operating costs for all facilities including control and process buildings

3. Prepare tables and charts summarizing cost data for the entire Facilities Plan

C. Manage Report Production

1. Develop the schedule for report production

2. Finalize the report outline and assign sections

3. Prepare and assemble the text for the Draft Facilities Plan

D. Review responses to agency reviews from WP PR-61A, Response to Reviews. Approval to proceed with Subtask E will be obtained from the Massachusetts Division of Water Pollution Control.

E. Prepare and assemble the text for the Final Facilities Plan

F. Prepare the text for a draft and final Executive Summary

G. Prepare preliminary design reports. Each report will include a description of the scope of the design contract, interrelationship with other project components, preliminary design drawings and description from the facilities plan, design criteria, cost estimates, preliminary list of permits and approvals that are required and special consideration including mitigation and equipment procurement (single vs. multiple manufacturers).

H. Prepare slide presentation or videotape of the design concepts to be used for informing the MWRA Board, staff and general public of project findings and recommendations.

I. Prepare and deliver microfilm copies of the final report.

III. WORK PACKAGE PRODUCTS

The work package products include:

1. Outline of Report and Report Format

2. Document production schedules and responsibility assignments

3. Texts for:
   - Draft Facilities Plan
   - Final Facilities Plan
   - Executive Summary
   - Preliminary Design Reports

4. Slide presentation or videotape of the design concepts

5. Microfilm copies of the final report

   Note: Printing of the draft and final reports are budgeted in WP CU-80

IV. REQUIRED WORK PACKAGE INPUTS

Inputs required to complete this work package include:

1. Text and recommendations from engineering, environmental and institutional Work Package Leaders

2. Comments and response to comments on the Draft Facilities Plan from WP PR-71A, Response to Reviews

V. RESPONSIBILITY

Richard Fox maintains overall responsibility for this work package with assistance from the area managers, William Callahan, John Gall and Jean McCluskey.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 3

WORK SUMMARY: P - RECOMMENDED PLAN

WORK GROUP: PT-70 RECOMMENDED PLAN

WORK PACKAGE: PT-70B IMPLEMENTATION PLAN/SCHEDULE

I. DESCRIPTION OF SCOPE

The scope of this work package is to develop an implementation schedule/plan for each design and construction phase of the recommended plan (WP PT-70A) and to develop the overall project implementation schedule. The scope of this work package includes:

A. Develop an implementation plan for the recommended plan.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Develop Implementation Plan

1. Assemble potential individual design and construction contracts using the findings of WP FS-40B Construction Planning and create an overall summary critical path schedule of major contracts, assessing impacts and time constraints. The long-term target dates entered by the federal court shall guide the development of the implementation plan.

2. Incorporate the Permitting Plan developed in WP IN-62B, recognizing all necessary and potential permits.

3. Identify individual contract scopes, timelines for major project tasks, costs and responsibilities.

4. Coordinate with Residuals Management Facilities Plan.

5. Prepare a summary of any discrepancies between the implementation plan and the federal court target dates including a summary of the justification for any proposed modifications to the target dates.

III. WORK PACKAGE PRODUCTS

The work package products include:

A. Implementation plan/schedule

B. Memorandum on court schedule summarizing changes to present time lines and target dates.

IV. REQUIRED INPUTS

The inputs required to complete this work package include:

A. Recommended plan conceptual design developed under engineering work packages
B. Construction planning from WP FS-40B
C. Regulatory analysis from WP IN-62A and the permitting plan from IN-62B
D. Mitigation Plan developed from WP EI-50D
E. Public participation comments from WP IL-60A
F. Federal court target dates

V. RESPONSIBILITY

This task is conducted by CDM under the overall direction of Richard Fox, Project Manager. He will be assisted by William Callahan, Manager of Facilities Engineering and Program Implementation tasks.

Approved: _____
MWRA

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CDM/S&W
Date: _____
Rev: 7

WORK SUMMARY: P - RECOMMENDED PLAN

WORK GROUP: PR-71 AGENCY REVIEW

WORK PACKAGE: PR-71A RESPONSE TO AND COORDINATION OF REGULATORY REVIEWS

I. DESCRIPTION OF SCOPE

The scope of this work package is to coordinate and to respond to reviews by the regulatory agencies of the interim and final outputs that will be produced during the project. The response to comments on the EID will be provided under WP EI-50E. Coordination and comments on the EIR will be provided under WP EK-41G Agencies Reviews (EIR).

The project schedule developed in WP MA-01A will be incorporated into a regulatory review schedule. Highlighted on this schedule will be deliverables, milestones and coordination meetings. As agency comments are received, coordination, review and responses will be completed.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

1. Review project schedule from WP MA-01A to highlight review tasks. Review the schedule created under WP MQ-02 for project Coordination Program. Establish milestones and meetings for review efforts. Reviews include numerous technical memoranda (including reports; engineering design, site layout, construction, costs, regulatory and permitting requirements; and O&M), schedules, the public participation program, the draft and final Facilities Plan (including EID) and the Mitigation Plan.
2. Develop for comment and revise as appropriate a plan/schedule of proposed agency review.
3. Coordinate and expedite agency reviews.
4. Receive and review agency comments.

5. Prepare responses to address concerns and comments.

III. WORK PACKAGE PRODUCTS

The products of the work package include:

1. A plan for agency review developed in conjunction with WP MQ-02, Agency Coordination, indicating the schedule and type of review required.
2. Compilation of agency review comments.
3. Responses to comments.

IV. WORK PACKAGE INPUTS

The inputs required to complete this work package include:

1. Project schedule from WP MA-01A.
2. Project coordination schedule from WP MQ-02.
3. Coordination of agency reviews associated with MEPA comments.
4. Agency comments.
5. Coordination with Residuals Management Facilities Plan.

V. RESPONSIBILITY

The overall responsibility for response to agency reviews lies with Richard Fox, Project Manager. Each Area Manager will be responsible for reviewing comments and ensuring the development of a response to agency comments.

APPROVED : _____
MWRA

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CDM/S&W

DATE : _____

REV : 0

WORK SUMMARY: C-PROJECT REPORT AND COMMUNICATIONS PREPARATION

WORK GROUP : CU-80 - REPORT AND COMMUNICATION PREPARATION

WORK PACKAGES: CU-80A - CLERICAL SERVICES
CU-80B - PUBLICATIONS/MEDIA COMMUNICATIONS PRODUCTION

I. DESCRIPTION OF SCOPE

Originally, the scope of this work package was to provide direct office services and report production functions in support of the project. The budget and manhours to support the office services portion of this work package has been divided among all the individual work packages. Each work package has been allocated manhours and a budget based on their respective/anticipated needs for support services (clerical). The second aspect of this work package is the effort required to produce the project end documents, and provide the MWRA with microfilm copies of the Final Report. This aspect of the scope is addressed here.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include :

A. Manage production of project technical memoranda, reports and documentation.

1. Establish report and document formats
2. Produce report graphics

3. Edit project reports and documents
4. Coordinate and perform printing and distribution

B. Assist in the production of technical materials generated under WP's IL-60A and 60B and WP MQ-02.

III. WORK PACKAGE PRODUCTS

The work package products include :

A. 150 copies each of the Interim Reports listed below :
1. Flows/loadings and Effluent Limitations
2. Screening of Alternatives
3. Detailed Evaluation of Alternatives
4. Harbor Perspective
5. Preliminary Design Report - Site Preparation
6. Preliminary Plan of Operations
7. Preliminary Plan of Construction

B. 150 copies of the Interim Draft Facilities Plan Report

C. 200 copies of the Final Draft Facilities Plan Report

D. 300 copies of the Final Report

E. 400 copies of Executive Summary Report

F. 25 copies each of Preliminary Design Reports on each proposed separate design contract

G. Microfilm copies of Final Facilities Plan Report (4 sets)

IV. REQUIRED WORK INPUTS

Inputs required to complete this work package include :

A. Project management and engineering input to reports, memoranda and documents

V. RESPONSIBILITY

The Project Manager, Richard Fox, has overall responsibility for ensuring that publications and communications services are provided

in an effective manner. Doreen Zankowski will assist in the overall work package coordination.

Approved: _____
CDM/S&W

_____
MWRA

Date: _____

Rev: 0

WORK SUMMARY: EIR

WORK PACKAGE: Chlorination Reduction Study

I. DESCRIPTION OF SCOPE

The scope of this work package is to determine what impact, if any, different levels of applied disinfectant (chlorine) have on the existing water quality in Boston Harbor as measured by coliform bacteria. The study is intended to identify the seasonal requirements, via full scale piloting, of the need for chlorine to protect public health. A reduction in chlorine usage would reduce the level of required trucking thereby minimizing risk to adjacent neighborhoods. The impact on aquatic life will also be assessed. The results of this study will be used to evaluate the need for disinfection at the alternative outfall locations by identifying natural die-off rates. Studies will be conducted on Nut Island to minimize other interferences.

In order to determine the effects of a reduction in chlorination, the amount of chlorine added to the wastewater will be reduced in a "step-down" fashion. Subsequent bacteriological sampling of the waters surrounding the outfall will be conducted at specified intervals at various locations. Based on results of sampling following each "step-down", the effect on coliform density in the Harbor will be evaluated and a decision to continue reducing chlorine levels or to remain at a particular level will be made. A sampling program will be prepared and submitted prior to initiation of the sampling. At the completion of the study, a technical memorandum outlining the results of the study will be prepared.

The scope of this work package is divided into three major subareas as follows:

A. Program design, including review of existing chlorination, bacteriological and circulation data, meetings with State and

local officials and establishment of specific sampling stations and protocols.

B. Field programs, including the sampling of wastewater, harbor water, and shellfisheries for coliform organisms at varying levels of disinfection.

C. Data analysis and report preparation, including the evaluation of collected data to determine coliform fate and transport and preparation of draft and final reports.

II. TASKS AND ACTIVITIES

A. Program Design

1. A review of existing chlorination studies at Deer and Nut Island will be conducted.

2. The bacteriological sampling in the area of Nut Island collected by the DEQE and the U.S. Public Health Service will be obtained.

3. The existing oceanographic data such as circulation patterns and currents will be obtained from MWRA studies.

4. A meeting will be held with the DEQE Shellfish Sanitation Program and with the shellfish personnel at the Lawrence Experiment Station to discuss the procedures for bacteriological analysis, sampling collection and handling, and for a review of existing data. A meeting will be held with the Division of Marine Fisheries to determine the implications of this study to the shellfish resource. A meeting will be held with the U.S. Public Health Service Northeast Technical Services Unit to review sampling techniques and bacteriological analyses.

5. Establish Monitoring Stations. Based on the existing bacteriological and oceanographic data, the location of the sampling stations will be determined.

   Up to eight sampling stations in 2 rows around the outfall, are proposed. The closest row will consist of 3 stations located in a semi-circle pattern. The second row will consist of 5 stations in a semi-circle at a greater distance from the outfall than the first row.

Three additional stations are proposed around the harbor, based on circulation patterns, to assess the potential impact of interference of wastewater from combined sewer overflows on the sampling stations at Nut Island.

Bacteriological samples will be collected at 3 depths at each station. They will be at the surface, one meter above the bottom and at the center of the water column.

Samples will be collected beginning one hour after high tide.

Three stations will be selected for monitoring fecal coliform levels in indigenous softshell clams.

6. Sampling Frequency

Five sampling data sets will be collected following each chlorination stepdown.

Samples will be collected in the following sequence as part of a stepdown.

Sample Data Set	Day
1	Prior to stepdown
2	2 days following stepdown
3	4 days following stepdown
4	7 days following stepdown
5	10 days following stepdown

A stepdown will be conducted during the first week of each month of the study. A stepdown will include a 20% reduction in the overall chlorine dosage but will not exceed a 3 mg/l decrease per stepdown. A sampling set will include water samples collected at each of 11 stations at each of 3 depths for a total of 33 samples/day.

The frequency for monitoring shellfish samples will be as follows:

Sample Set	Day
1	Prior to stepdown
2	4 days following stepdown
3	10 days following stepdown

Each sample will be collected as prescribed by the U.S. Public Health Service and the DEQE.

B. Sample Collection and Analysis

1. Each sample will be analyzed according to accepted procedures at a Massachusetts State certified laboratory.

2. Field analysis will include measurements for salinity and temperature using a YSI conductivity meter and a calibrated centigrade thermometer.

3. Water samples will be analyzed for fecal coliform and entercocci at each station at each depth.

4. Shellfish samples will be analyzed for fecal coliform levels only.

C. Data Analysis and Report Preparation

1. The results of the field program will be reviewed to produce interim memoranda and draft and final reports. The interim memo will be produced approximately bi-monthly, detailing the results of the most recent field tests, and making suggestions as to the potential program modifications.

   The draft and final reports will be produced to document the conclusions and methodologies of the reports, along with detailed recommendations as to the need for both year-round and seasonal disinfection.

III. WORK PACKAGE OUTPUTS

The work package products include:

1. Approximately bi-monthly, progress memorandums which will be prepared and will contain a summary of previous sampling results.

2. A draft final report describing the procedures used in the study. The report will include an analysis of all data and a recommendation for the appropriate seasonal chlorination levels which should be used. The draft report will be submitted 6 weeks after completion of the final sampling.

3. A final report, to be submitted 4 weeks following receipt of comments on the draft report.

IV. REQUIRED INPUTS

Inputs required to complete this work package include:

- o Existing reports from project libraries

V. SCHEDULE

	Start	Finish
A. Program Design	10/01/86	11/15/86
B. Field Program	12/01/86	04/01/86
C. Reports	04/01/87	07/01/87

VI. RESPONSIBILITY

This task will be undertaken by Mr. Daniel Viscardi, under the direction of Jean McCluskey.

Approved: _____
MWRA

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CDM/S&W

Date: _____
Rev: 4

WORK SUMMARY: I - INSTITUTIONAL

WORK GROUP: IM-61 FINANCIAL IMPACTS

WORK PACKAGE: IM-61A CASH FLOW PROJECTIONS

I. DESCRIPTION OF SCOPE

The purpose of this task is to develop an annual cash flow projection of the monies required for the construction of the facilities recommended by this facilities plan. The cash flow projections will reflect the construction schedule target dates entered by the federal district court including any modifications to those target dates recommended by this facilities plan. Major subtasks include:

A. Review of the estimated capital costs and the schedules for each construction package identified in Task FM-37A - Cost Estimates and in Task PT-70B - Implementation Plan/Schedule.

B. Review of potential funding sources and possible grant funding scenarios to identify a range of likely grant or loan assistance.

C. Develop cash flow projections on an annual basis for the proposed construction period using a computerized financial spread sheet that is compatible with the capital improvement planning and budgeting of MWRA.

II. TASKS AND ACTIVITIES

The tasks and activities included within this work package include:

A. Assemble Capital Costs and Schedules

1. Assemble the final estimated costs of the facilities contained in the recommended plan. Task FM-37A - Cost Estimates.

2. Assemble the schedule of construction recommended for each construction package identified in Task PT-70B - Implementation Plan/Schedule.

3. Review projected trends in generally accepted construction cost indexes and develop a likely range for anticipated cost escalation.

B. Review Funding Sources

1. Review funding levels likely to be available through state and federal funding/loan programs.

2. Estimate the range of state and federal funding assistance likely to be available to defray the costs of constructing the recommended facilities.

C. Develop Cash Flow Projections

1. Develop a schedule of the local monies required to support the recommended construction program, considering both alternate schedules and alternate levels of grant/loan assistance.

2. Display cash flow projections using CDM's PABAC model (Planning, Analysis, Budgeting and Control of Public Investment).

3. Summarize the cash flow projections and their underlying assumptions in a technical memorandum whose format is consistent with MWRA's capital budgeting process.

III. WORK PACKAGE PRODUCTS

A. Technical memorandum summarizing the cash flow projections and their underlying assumptions.

B. Microcomputer based spreadsheet used to prepare the cash flow projection 1987.

IV. REQUIRED INPUTS

A. Cost estimates from Task FM-37A - Cost Estimates
B. Construction package schedules from Task PT-70B - Implementation Plan/Schedule

V. RESPONSIBILITY

This task will be conducted under the direction of John Gall, Manager of Institutional Analyses with assistance from Doreen Zankowski.

Approved: _____
MWRA

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CDM/S&W

Date: _____

Rev: 3

WORK SUMMARY1 - INSTITUTIONAL

WORK GROUP: IM-61 FINANCIAL IMPACTS

WORK PACKAGE: IM-61B FINANCIAL ANALYSIS

I. DESCRIPTION OF SCOPE

The purpose of this work package is to provide a summary of the financial impacts of the recommended plan on MWRA's customers. The analysis will include an assessment of the costs of the recommended plan with various levels of funding assistance for the recommended capital expenditures.

The scope of this work package includes:

A. Review of existing and planned MWRA cost recovery mechanisms (rates and fees) to assess the likely cost recovery principles to be employed.

B. Summarize the estimated debt service and operations/maintenance costs of the recommended facilities plan.

C. Obtain the fiscal objectives of the MWRA and assess the ability of the current or planned cost recovery systems to meet these objectives considering the level and sequencing of the planned construction expenditures.

D. Identify potential changes in either the planned schedule of construction or the current or planned cost recovery programs that may facilitate sound fiscal policy for supporting the recommended construction plan. Approval to proceed with Subtask E will be obtained from the Massachusetts Division of Water Pollution Control.

E. Assess the impact of alternative plans on member community rates by estimating rate impacts on three MWRA member

communities which will be selected to represent the range of retail cost recovery mechanisms at use in the service area.

F. Prepare an EPA "Financial Capability" evaluation.

G. Prepare a Summary Memorandum

II. TASKS AND ACTIVITIES

The tasks and activities within this work package include:

A. Review of Existing Cost Recovery Mechanisms

1. Review MWRA's current and projected capital and operations budgets
2. Review MWRA's current procedures for allocating costs to member communities
3. Identify cost recovery principles likely to be employed by the MWRA for the recommended facilities plan

B. Prepare Estimated Costs

1. Summarize the estimated costs of constructing the recommended facilities using the cash flow projections prepared in Task IM-61A Cash Flow Projections
2. Summarize the projected costs of operating/maintaining the recommended facilities using the estimates prepared in Task FM-37A Costs Estimates
3. Summarize the current levels of debt service and current operating budgets
4. Summarize the projected cash flow projections for other wastewater construction programs and the projected operations budgets for these other recommended construction programs

C. Obtain Fiscal Objectives

1. Review the objectives identified by MWRA for the construction and operation of wastewater treatment facilities
2. Consult with MWRA's financial advisor to identify fiscal and financing conditions such as preferred debt coverage, reserves and rate adjustment factors
3. Analyze the potential of the current rate policy to generate the revenue needed to meet the financial commitments of the recommended plan

4. Estimate the potential impact of the recommended plan on MWRA's future user charges (wholesale rates)

D. Assess Impacts on Three Member Community Retail Rates

1. Select three member communities which represent the range of retail rate practices at use in the service area. Include one community whose rates are fully cost loaded, one community which recovers all direct expense through rates, and one which recovers only a fraction of its expense through rates.
2. Project retail rates within these communities which would result from increasing MWRA assessments. Use the current rate practices as a basis for projection.

3. Obtain approval of the Massachusetts Division of Water Pollution Control to proceed with Subtask E.

E. Identify Potential Changes

1. Identify potential changes to current cost recovery principles that may facilitate achievement of the MWRA fiscal objectives
2. Identify potential changes in the recommended plan and schedule that may facilitate the achievement of MWRA's fiscal objectives
3. Summarize the fiscal impacts of the recommended plan and potential changes to both the plan and current cost recovery principles that may be available to the MWRA

F. Prepare Financial Capability Statement

1. Following review and acceptance of the assessment of financial impacts of the recommended program with MWRA, prepare an EPA Financial Capability Statement using the forms and guidelines provided by the U.S. Environmental Protection Agency

G. Prepare Summary Memorandum

1. Prepare a draft memorandum of the projected impacts of the recommended facilities plan on MWRA's long term fiscal program and user charges, including a summary of potential changes in either the recommended plan or current cost recovery principles that may facilitate achievement of MWRA's fiscal objectives.

2. Prepare a final memorandum summarizing the potential financial impacts of the recommended facilities incorporating comments from MWRA.

III. WORK PACKAGE PRODUCTS

The work product of this task will be a memorandum summarizing the potential financial impacts of the recommended program and possible changes in either the program or current cost recovery principles that may facilitate the achievement of MWRA's fiscal objectives.

IV. REQUIRED INPUTS

Inputs required to complete this work package include:

1. Cash flow projections from work task IM-61A
2. Costs estimates from work task FM-37A
3. Cash flow projections and estimated operating budgets for other recommended projects (by Others)
4. Current and projected operating budgets, debt service schedules and cost recovery procedures (from MWRA).
5. Three communities to serve as representative

V. RESPONSIBILITY

This work package will be directed by John Gall and prepared by Dave Laredo and Doreen Zankowski.

Approved: _____
MWRA

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CDM/S&W
Date: _____
Rev: 4

WORK SUMMARY: I - INSTITUTIONAL

WORK GROUP: IN-62 INSTITUTIONAL ANALYSIS

WORK PACKAGE: IN-62A REGULATORY ANALYSIS

I. DESCRIPTION OF SCOPE

The scope of this work package is to identify proposed changes or proposed additional laws, regulations, legislative restrictions and agreements that could affect or constrain the capability of MWRA to implement the recommendations of the Facilities Plan and to suggest action that may be needed to respond to proposed changes.

A thorough tracking and review of all regulatory requirements and federal and state agency actions will be delivered to all work package managers. Under this work package a complete review of summaries of policy issues and new regulations will be conducted. As the facilities plan progresses, quarterly meetings will take place with MWRA project and legal staff and a review of critical facilities planning dates will be assessed. The potential impacts of existing or proposed regulations will be discussed at these meetings.

II. TASKS AND ACTIVITIES

This work package includes tasks and activities to:

1. Identify, in conjunction with work package managers, the regulatory requirements and key agencies associated with implementing feasible wastewater treatment alternatives. Assist managers with analysis of existing regulations pertinent to air, water, noise, historical preservation, chlorine use and handling and other germane regulations.

2. Identify, in conjunction with work package managers, the existing legislation and outstanding agreements providing for future additional or extraordinary services between MWRA and member communities.

3. Review summaries of issues produced under policy level input (WP MQ-02).

4. Review new regulations as they are issued and/or proposed and define their potential impact on MWRA's Facilities Plan and operations.

5. Review critical facilities planning dates for informational requirements, meetings, reviews, and approvals (from WP MA-01A).

6. Identify potential regulatory, legislative or legal revisions anticipated.

7. Recommend appropriate modifications to Massachusetts legislation, regulations, agreements and contracts that may be necessary to implement the preferred alternative.

8. Prepare and submit for review and comment draft technical memoranda and portions of the draft and final facilities plan presenting the legal and regulatory requirements and issues associated with implementing the preferred alternative.

9. Review the progress of work with MWRA project staff and legal counsel on a quarterly basis.

III. WORK PACKAGE PRODUCTS

The work package products include:

1. Technical memoranda on existing or proposed legislation regulations and issues.

2. Technical memoranda recommending modifications to legislation, regulations, etc.

3. Summaries of proposed legislation and regulation and the potential impacts of the legislation/regulation for use by MWRA staff and work package managers.

IV. REQUIRED WORK PACKAGE INPUTS

The required work package inputs include:

1. Detailed work plan and schedule (WP MA-01A)
2. List of policy issues (WP MQ-02)
3. Requests for regulatory analysis from workpackage managers.

V. RESPONSIBILITY

This work package will be directed by John Gall and prepared by Robert Prolman and Doreen Zankowski.

Approved: _____
CDM/S&W

_____
MWRA

Date: _____

Rev.: 3

WORK SUMMARY: I-INSTITUTIONAL

WORK GROUP: IN 62 - INSTITUTIONAL ANALYSIS

WORK PACKAGE: IN 62B - PERMITTING PLAN

I. DESCRIPTION OF SCOPE

The purpose of this task is to describe potential permit and regulatory agency approval requirements and prepare a preliminary permitting plan. The preliminary permitting plan will ensure a coordinated approach for securing the necessary permits, and approvals to support construction and operation activities. This task supports the implementation plan and schedule activities for the recommended plan.

The scope of this work package is divided into the following major subareas:

A. Analyze Regulatory Requirements. The purpose of this task is to analyze potentially applicable laws and regulations as they may impact permitting and approvals and to prepare a summary of permits potentially applicable to the facilities.

B. List Permits/Approvals. The purpose of this task is to list federal, state, and local permits and approvals potentially required for the proposed actions. Responsible agencies will be consulted to discuss details of actions requiring permits and address permitting procedures and schedules, including public hearings. Fact sheets will be prepared for each potentially required permit and approval summarizing the above.

C. Prepare Permitting Plan. The purpose of this task is to prepare a preliminary permitting plan which provides a master inventory of the permits and approvals required from regulatory agencies; procedures and schedules; and an overall coordinated approach to

eliminate duplication and provide timely implementation. The plan will discuss issues which may affect or constrain issuance of the required permits, and recommend approaches to minimize impacts.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package include:

A. Analyze Regulatory Requirements

1. Summarize facilities and activities required for the construction and operation of the treatment plant that may require a permit or approval using information from conceptual engineering activities (WP's FD 31B, FE 32A, FF 33E, FF 33F, FF 33G, FG 34C, FG 34D, FG 34E, FJ 36A, FO 38A and FS 40B).

2. Analyze laws and regulations applicable to permits and identify potential permits and approvals. This effort will be coordinated with that under WP 62A, Regulatory Analysis.

B. Identify Permits/Approvals

1. Develop a preliminary list of required federal, state, and local permits and approvals and responsible regulatory agencies or commissions.

2. Consult with the responsible agencies or commissions to assess need for permits/approvals, and to discuss details of procedures, timing of required reviews and public hearings, and interrelationships with other permitting processes.

3. Finalize list of required permits/approvals.

4. Prepare a fact sheet for each permit/approval which summarizes the above information for ready use.

C. Prepare Preliminary Permitting Plan

1. Develop major tasks and activities that are required from preparation of permit applications through receipt of permits/approvals, describing major interrelationships.

2. Prepare an overall permitting schedule and integrate into the project implementation schedule in WP PT 70B.

3. Examine and discuss issues which may affect or constrain im-

plementation schedule in WP PT 70B.

4. Analyze options which may exist for minimizing the impact of issues and constraints and develop a recommended approach.

5. Prepare a memorandum summarizing the preliminary permitting plan for the recommended facilities plan.

III. WORK PACKAGE PRODUCTS

The work package products include:

1. List of potentially applicable permits/approvals

2. Permit fact sheets

3. Memorandum summarizing the permitting plan

IV. REQUIRED WORK PACKAGE INPUTS

Inputs required to complete this work package include:

1. Descriptions of facilities being provided for the recommended plan from the engineering work packages under Facilities Engineering (WP's FD 31B, FE 32A, FF 33E, FF 33F, FF 33G, FG 34C, FG 34D, FG 34E, FJ 36A, FO 38A, and FS 40B).

2. Information on regulatory requirements from WP IN 62A, Regulatory Analysis.

3. Implementation schedule and plan inputs from WP PT 70B.

V. RESPONSIBILITY

Mr. Dennis G. Tuttle, as Work Package Engineer, is responsible for the Execution of this work package under the direction of Mr. John Gall, Institution Area Manager.

Approved: _____
MWRA

_____
CDM/S&W

Date: _____

Rev: 4

WORK SUMMARY: I - INSTITUTIONAL

WORK GROUP: IC-63 FLOW AND PERFORMANCE/REMOVAL CRITERIA
CDM/S&W

WORK PACKAGE: IC 63A FLOW AND LOAD ESTIMATION

I. DESCRIPTION OF SCOPE

The purpose of this task is to project flows and loadings to the Deer Island Treatment Plant, to provide relevant design information to facilities engineers, and to provide the Authority with a basis for evaluating future growth in flows and loads. The scope of this work package is divided into five major subareas, as follows:

A. Definition of the planning area, the purpose of which is to define the geographical extent to which flow and load estimates might be made. The planning area is expected to initially encompass an area larger than the existing service area, although the final service area may not be as large as the planning area.

B. Accumulation of information relevant to wastewater flow and load projections. This task encompasses the acquisition and review of information such as population projections, zoning, industrial and commercial flow estimates which are necessary to project future flows and loads. Substantial use is made of the work undertaken as part of previous wastewater and water supply planning.

C. Estimation of future year's flows and loads. The purpose of this task is to estimate future year's flows and loadings, based on the information accumulated as part of B. Estimates of key design parameters (maximum day flow, minimum flows, etc.) are made. Sensitivity analyses are presented showing the impacts of changes in the service area, rates of growth, and impacts of pricing and regulatory strategies on future flows and loads.

D. Segregation of Flows and Loads by Headworks. The purpose of this task is to provide information on the key subdrainage

basins of the Authority's service area. This information will be used for evaluation of headworks systems, as well as for confirmation of flow and load projections and future tracking of flows and loads.

E. Technical Reports and Memoranda. The purpose of this task is to present documentation of the work conducted under this work package.

II. TASKS AND ACTIVITIES

The tasks and activities associated with this work package includes:

A. Define planning area

1. Review historical basis of planning areas
2. Review MWRA legislation re: service areas
3. Prepare recommendations for planning area (which may be different than service area ultimately proposed)

B. Accumulate information relevant to WW flow projects

1. Population projections/water consumption data

a. Site option study
b. LRWSS (MWRA water supply study)
c. 1980 US census data
d. Most recent state census
e. Most recent state population projections
f. Water consumption from LRWSS and others

2. Data on industrial/commercial waste flow

a. MWRA industrial file data
b. LRWSS and relevant updates
c. Other sources

3. Zoning data

a. MAPC documents
b. Local community planning documents

4. Estimates of community I/I

a. MWRA south and north system studies
b. DWPC studies

APPENDIX B

SECONDARY TREATMENT FACILITIES PLAN

LONG TERM SCHEDULING ORDER

APPENDIX B

UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

UNITED STATES OF AMERICA.
Plaintiff

Civil Action
85-0489-MA

Vs.

METROPOLITAN DISTRICT COMMISSION. et al..
Defendants

CONSERVATION LAW FOUNDATION OF
NEW ENGLAND. INC..
Plaintiff

Civil Action
83-1614-MA

Vs.

METROPOLITAN DISTRICT COMMISSION. et al..
Defendants

LONG TERM SCHEDULING ORDER

Mazzone. D.J.

May 8. 1986

An evidentiary hearing in this case was held on May 1 and 2. 1986. after the parties failed to agree upon proposed long term target dates for the completion of various steps necessary to the construction of the new sewage treatment facilities for Boston Harbor. These new facilities are being constructed pursuant to findings by this Court on September 5. 1985 that the defendants were in violation of Federal Clean Water Act standards. For years. Boston Harbor has been seriously and dangerously polluted. A brief review of the background of the disagreement as to long term dates is helpful to an understanding of the issues currently before the Court.

The parties initially filed proposed long term schedules in February. 1986. At that time. the Massachusetts Water Resources Authority ("MWRA") proposed a completion date for the secondary treatment facility in the year 2002. The Conservation Law Foundation ("CLF") proposed a completion date in 1996. The Environmental Protection Agency ("EPA") proposed a completion date in 1998. The MWR's initial schedule was based on an analysis prepared by its engineering consultants. Camp. Dresser & McKee ("CDM"). CDM. as part of its duties. had previously prepared a "critical path method" (CPD) flow chart. which. with the assistance of a computer. scheduled the myriad steps necessary to complete the project in the shortest possible time. While the other parties disagree as to the assumptions about duration and sequencing of tasks

made by CDM. CDM's critical path method, as revised, has been the yardstick against which the other schedules have been measured. Because the CMP is critical in planning and carrying out this complex project, it is important to understand what benefits it provides. Basically, it shows the starting date and completion date for activities to be performed on a project. It will depict (1) activities which precede other activities; (2) activities which must be performed concurrently; and (3) activities which must succeed other activities. It will usually assign four dates for each activity: early start, early finish and late start, late finish. For some activities, there is leeway or "float" in performance which will not affect overall project performance. The CPM is also important once work begins since it will provide, with necessary and continuous updates, early warnings of impending problems and delays. Finally, it can be used to justify or prove delay claims.

Despite ongoing negotiations between the parties, these dates remained the same until approximately two weeks ago. At that time, the EPA, CLF and the MWRA managed to agree on some, but not all, of the so-called "milestone" target dates. These milestone target dates will establish the start and finish dates for the following activities: facilities planning; site access; site development (Phasse I); primary plant construction; under harbor tunnel construction; new outfall construction; site development (Phase II); and secondary plant construction.

As a result of the parties' failure to agree upon all essential milestone target dates, an evidentiary hearing was scheduled. All parties including the City of Quincy, the Town of Winthrop, and the Boston Water and Sewer Commission were afforded an opportunity to present expert testimony concerning the appropriateness of proposed long term target dates. The subject matter of th hearing was expllicitly limited to such long term target dates. As a result, no evidence was presented on related issues such as sludge and scum discharges. All parties were given an opportunity to examine the expert witness called by the EPA, CLF, and the MWRA. The parties decided to rely upon their prior submissions on the issue of the financial implications of the different proposed schedules.

I.

Based on the submissions to date and the testimony offered at the hearing, I make the following general findings.

First, long term target deadlines are essential to the succesful clean up of Boston Harbor. Although my initial scheduling order in this case was entered a mere five months ago, it is already clear that specific dates must be established for each major step of this long and complex construction project. The parties must be held to a clear, understandable, and rational schedule. The Court and the public must be able to hold specific individuals and agencies responsible for accomplishing specific tasks within given time periods.

I also find that the target dates established today must be just that: target dates. The complexities of the construction project before the Court are vast in scope. There will, of course, be instances in which various specific deadlines will have to be altered due to circumstances unforeseeable at the moment. There will also be occasions on which specific

tasks can be completed more quickly than currently anticipated. Therefore, these target dates will be subject to review at the end of facilities planning. Nonetheless, target deadlines create a framework within which the parties may work together to accomplish the common goal. I also do not underestimate the importance of giving the citizens of this Commonwealth a public assurance that Boston Harbor will be cleaned up within a defined period of time.

Despite the negotiations between the parties in the last few weeks, and their agreement on certain dates, they have been unable to present to the Court a jointly proposed schedule of specific long term dates for the construction of the new treatment plants and related facilities. This Court has jurisdiction to protect the cleanliness of the Harbor and the safety of the citizens who enjoy and use that Harbor, even in the absence of an agreed schedule. Thus, given that the establishment of long term target dates is essential to the cleanup of the Harbor, I must set such dates at this time.

II.

Turning now to the evidence before me, I find that the financial considerations raised by the different proposed schedules are not determinative of the schedule selected. In particular, I accept the statements of John Petersen, the EPA's financial expert, that the MWRA's financial expert, Mark Ferber, greatly overestimates the difference between the financial impacts of the MWRA's proposed schedule and that of the EPA. I accept Mr. Petersen's statement that over fifty percent of the asserted difference in cost between the two schedules is attributable to operation and maintenance costs arising from earlier completion of the project. Earlier completion means earlier compliance.

I also agree with Mr. Petersen that the assumption made by the MWRA's expert that there will be a twenty percent reduction in the level of federal funding if the EPA's construction schedule is accepted is completely unfounded. While I have some concerns about Mr. Petersen's assumption that there will be no difference in the capital costs involved in any of the three schedules he analyzed, I have not been presented with sufficient evidence to the contrary to disbelieve him. I am also unpersuaded by Mr. Ferber's assumption that the capital requirements for constructing the new treatment facilities under the CLF schedule would be twenty percent greater than under the MWRA schedule.

Finally, I accept Mr. Petersen's statement that the market for tax exempt bonds in December 1985 was highly unusual due to bond buyers' anticipated concerns with impending federal tax reform efforts. Mr. Ferber's assumption that the MWRA would experience the same difficulties in marketing its bonds as were encountered by bond issuers in December 1985 is therefore inappropriate. The financial consultant retained by CLF also filed an affidavit in the case. His opinion that bond financing of this project within the next 10 to 12 years is possible, essentially supports Mr. Petersen's view and contradicts Mr. Ferber's view. Based on these affidavits, therefore, I find that the differences in cost associated with the different target completion dates is insufficient to affect my decision as to the appropriate long term construction target dates.

I turn now to the merits of the various schedules proposed by the parties.

a. MWRA's Proposed Schedule

As noted above, approximately two weeks ago the MWRA filed a report containing a revised construction schedule which accelerates the construction time table it originally proposed. Under the MWRA's new schedule, construction of the new primary components will be completed in 1994 and fully operational in 1995. Completion of construction of the secondary components is targeted for the year 1999. The proposed schedule requires completely "sequential" construction of the new primary and secondary plants. Sequential construction means that the new primary plant will be built in its entirety before any construction commences on the secondary plant.

Closely related to the "sequencing issue", as it has been referred to by the parties, is the thornier problem raised by the existence of the Deer Island House of Correction. The prison takes up a significant part of the very limited acreage available on Deer Island. The MWRA argues that the Deer Island House of Correction should be relocated both as a matter of building an environmentally sound plant and to comply with the determination that the removal of the prison is a mandatory mitigation measure under the Massachusetts Environmental Policy Act. The MWRA has asked to be allowed to report to the Court on the relocation issue in June 1986, and has urged the Court to take no action until then.

The MWRA opposes the positions of CLF and the EPA that the plant can be built in a shorter time period. Specifically, the MWRA states that CLF's schedule requires simultaneous construction of both the primary and secondary treatment facilities at the cost of an additional billion dollars. Further, it claims that CLF's schedule would delay primary plant operation by a year more than the MWRA's schedule. CLF's schedule would subject the neighboring Town of Winthrop to greater noise and other inconveniences due to the compressed construction schedule. CLF's proposed layout is extremely congested and unsafe from an engineering point of view, and the CLF schedule places almost all critical construction elements on the so-called "critical path" of construction.

The MWRA also opposes EPA's proposed schedule because it has almost all the same disadvantages as does CLF's schedule and ignores both the inter-relationship between construction and operation and the severe constraints on construction imposed by the New England climate and the smallness of the chosen site.

b. EPA's Proposed Schedule

The EPA, on behalf of the United States, has moved for target construction dates that would require completion of the secondary plant in the fourth quarter of 1997. The Government argues that the MWRA's original schedule was too long and allowed for almost a two-year delay between completion of the primary plant and commencement of secondary plant construction. The EPA has recently reached agreement with the MWRA on the timing of certain specific target dates namely those for pier and staging areas, commencement of primary treatment construction, and construction of the under-harbor tunnel. The EPA strongly disagrees with the MWRA's proposed completion date of 1999 for the secondary plant.

The EPA argues that the MWRA is short-sighted in failing to have a contingency plan in case the prison is not relocated in a timely fashion. The EPA is adamant that a contingency plan be included in facilities planning in case the prison is not removed in a timely manner. Since facilities planning was due to commence at the end of April 1986, it is important that facilities planners be informed immediately whether they must proceed with a contingency plan. The EPA therefore opposes the MWRA's motion to wait until June for a report on the contingency issue.

c. CLF's Proposed Schedule

CLF has filed its motion urging that the Court set target dates requiring completion of primary and secondary treatment facilities in 1996. The CLF schedule requires completely overlapping construction of the primary and secondary construction projects. CLF relies on its engineering consultants, James Colantonio, and Arturo Ressi di Cervia, for the proposition that there can be concurrent construction of the primary and secondary components of the plant. CLF argues that the MWRA has conceded that concurrent construction may be feasible, although the MWRA still claims that this is not "desirable." CLF argues that the Federal Water Pollution Control Act requires early compliance, not later compliance. Thus, if a remedy is feasible, it should be imposed. Finally, CLF claims that its schedule is manageable and will not result in a significantly less reliable treatment plant.

As an initial matter, I deny the MWRA's motion to strike the affidavits of Mr. Ressi and portions of the second affidavit of Mr. Colantonio. I find that the issues raised by the MWRA concerning their qualifications to testify go to the weight of their testimony, rather than to its admissability.

d. Other Parties

The Town of Winthrop and the City of Quincy both support the schedule proposed by the MWRA. Quincy takes the additional position, through its expert, David Standley, that firm scheduling dates are inappropriate at this time. Mr. Standley testified, nonetheless, that in his opinion the MWRA's schedule is better than the other proposed schedules because it stresses the importance of a plant that is reliable in the long term. Predictably, the defendants, Boston Water and Sewer Commission and the Commonwealth of Massachusetts, also support the MWRA's proposed schedule.

e. Specific Findings

The EPA, CLF and the MWRA each presented expert testimony concerning the engineering and construction implications of the various proposed schedules. The EPA relied on the testimony of Joseph F. Lagnese, Jr., a professor of engineering who has had extensive experience in the field of sewage and waste treatment engineering. Mr. Lagnese was a careful, articulate, and well-reasoned spokesman who supported the EPA's proposed construction schedule. He explained his reasons for believing that sequential construction was unnecessary and would waste much precious time. He further explained that he believed there was no question that the EPA's schedule could be met, and that challenges made to that schedule in the affidavits and

testimony of other experts were unfounded. He explained that he had used the same time durations for the construction elements of the secondary treatment plant as did CDM (EPA's engineering consultants) in its critical path method.

The primary means by which Mr. Lagnese's schedule advances completion over the MWRA's schedule is by compressing the length of time allotted to construction of the primary plant and by deleting much of the start up time allotted to bring the new secondary plant on-line after completion of construction. His proposed schedule would require fifteen months of construction during which both the primary and secondary plants would be under construction. Due to the foreseen complications of overlapping construction, he extended the estimated duration of secondary construction by ten months. In other words, his schedule allows for a 15 month overlap, resulting in a net gain of five months.

CLF presented its schedule through two different witnesses, James J. Colantonio, and Arturo Ressi di Cervia. Mr. Colantonio has been involved in waste treatment projects in various capacities for the last seventeen years. He was involved in one wastewater treatment project involving a 309 million gallons per day facility, but has not had significant, direct supervisory experience in constructing wastewater treatment plants of a size comparable to the plant proposed for Boston Harbor. Mr. Colantonio reviewed the scheduled durations originally prepared by CDM in its critical path method and changed only those durations that he felt were overly generous. Because neither he nor his firm has extensive experience in actual treatment plant construction, he consulted with Mr. Ressi for advice concerning excavation and concrete pouring.

Mr. Ressi, who received a Ph.D. in engineering from the University of Bologna, is currently the president of ICOS Corporation, a company that specializes in sophisticated excavation and concrete construction problems. Mr. Ressi was clearly familiar with the day to day mechanics of construction sites, and was the only construction expert who testified at the hearing. Because of this, and due to his general credibility, it is impossible to resist the conclusion that, as to the limited issues upon which he was competent to testify, his opinion must be respected. He was adamant that there is more than ample room on Deer Island for "staging areas" (that is, storage of construction materials and related support facilities for contractors located on site). Counsel for the MWRA attempted repeatedly to undermine his testimony in this regard, but to my mind unsuccessfully. Mr. Ressi has excavated and poured foundations for enough projects and in closer confines that those presented at Deer Island, to be a believable expert on the adequacy of staging areas. I also accept his testimony that there is a "zone of efficiency" in large construction projects, in other words, that certain tasks can and should be compressed in time so as to take advantage of efficiencies in scale. Nonetheless, I am unable to accept all of Mr. Ressi's testimony since he did not have, and did not pretend to have, any particular expertise concerning matters such as the mechanical, electrical, and piping portions of the new treatment plants. Further, he was clearly unfamiliar with, and unimpressed by, state and federal environmental regulations.

Thus, while I find that the testimony offered by the engineering and construction experts presented by the EPA and CLF have merit, I compare it to the testimony offered by the MWRA. The MWRA's consultant, Richard D. Fox, was clearly a qualified expert. Mr. Fox has had

extensive, direct contact with many large wastewater treatment plants. CDM, by whom he is employed, has also had extensive experience in the field and is considered a national expert on the subject of constructing major wastewater treatment facilities. Mr. Fox was clearly better qualified and more familiar with the intricacies of the existing construction schedule than any other expert at the hearing. He explained satisfactorily to the Court why the dangers of accelerated construction could outweigh the benefits to be gained by the advancement of two years over the EPA's schedule, and several years over the schedule of the CLF. Further, while I am somewhat curious about the recent advancement in the MWRA's proposed target dates, I nonetheless find that the MWRA has made very substantial efforts to show that it intends to complete the project at hand in as expeditious a manner as it believes consistent with good engineering practice.

In particular, I commend the advancement of the proposed construction date for the under-harbor tunnel by approximately four years. Mr. Fox explained initially that this change was a result of increased efficiencies made possible by the "phased" construction of the primary plant.[1] Under the phased construction method, part of the new primary plant will become operative earlier than the entire plant. Because of this earlier completion of part of the primary plant and the earlier scheduled completion of the new long outfall, sewage from Nut Island (which currently collects most of the sewage generated by communities located to the South of Boston) can be routed from Nut Island through the new under-harbor tunnel, directly out the new long outfall and into the deeper waters outside of Boston Harbor itself. This will have the benefit of eliminating direct discharges into the shallow waters of Quincy Bay, thus improving the water quality at the beaches and along the shorefront of inner Boston Habor.

The MWRA also agreed to a suggestion made by the EPA that Phase II site development (i.e. site development necessary to the construction of the secondary treatment plant) can and should be overlapped with primary plant construction. As a result of this concession, there is now no waiting time between the construction of the primary and secondary plants. Also as a result of

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[1] I note with concern Mr. Fox's second explanation for the shortening of the under-harbor tunnel construction project. He explained that as a result of "assurances" received from state and federal regulators concerning the possibility of non-complying discharges resulting from accelerating the tunnel project, the MWRA agreed to accelerate that project. Whatever Mr. Fox's understanding may be, compliance with interim limits does not mean that there would not have to be compliance with the Clean Water Act.

the testimony of both Mr. Fox and Mr. Ressi, this modification seems both reasonable and necessary. I can easily understand that it takes longer to build a plant in two phases, one component of which must become operational before the other, than it does to build it all at once.

I also agree with Mr. Fox's assertion that Mr. Lagnese's estimated time duration for the construction of the primary plant may be too compressed. Mr. Lagnese's testimony seemed to fail to take into account the scope and complexity of the proposed construction project. I am particularly impressed by the fact that despite Mr. Lagnese's compression of the duration, he also felt it necessary to extend the time allowed for secondary plant construction due to the "complexities" of compressed construction. As a result of fifteen months of concurrent construction between the primary and secondary plant construction phases, Mr. Lagnese's schedule would gain only five months towards the final completion of the project. Mr. Fox persuasively pointed out the flaws in Mr. Lagnese's schedule, and I am forced to accept his opinion.

I must also agree with Mr. Fox that the schedule proposed by CLF must be rejected. I do note, however, that CLF has been a constant and useful spur to the other parties in this action. Nonetheless, I agree with Mr. Fox that an overly compressed construction schedule will result in the long run in a plant that is less reliable and, consequently, expensive to maintain. This community has long suffered the effects of living with an unreliable sewage treatment system. Despite my inclination to expedite the process, I cannot avoid the more convincing evidence and impose a schedule that may haunt the citizens of the Commonwealth for the next fifty years or more.

In setting the long term dates that will guide the facilities planners, there is one guiding priority: that all steps that will result in the immediate improvement of the Harbor must be taken as expeditiously as possible. Given the parties' substantial agreement that the new primary plant will be operational by 1995, the citizens of the Commonwealth can rest assured that there will be substantial improvement in the water quality of the Harbor by then. I note that all the parties agree that the dates for the secondary treatment plant are not firm dates. In other words, while setting these dates will assist the facilities planners to schedule the construction projects, these dates, more than a decade in the future, do not set fixed deadlines. Accordingly, while I do not underestimate the importance of setting target dates for the secondary treatment components for the new plant, I am more concerned that the parties focus on the step that will lead towards the greatest immediate improvement of the Harbor's water quality, namely the completion of the primary plant.

The completion of the primary treatment plant, accompanied by the completion of the under-harbor tunnel will have an immense effect on the task at hand. That completion, in 1995, will end Nut Island outfall discharges in the shallow waters off Quincy. The increased capacity of the Deer Island primary plant will end the discharge of untreated sewage directly into the Harbor from Moon Island, a most serious problem. Increased capacity of Deer Island, together with the new outfall, will bring additional and substantial improvement. These are some immediate benefits apart from secondary treatment. While I believe the 1999 date for secondary treatment is supported by the more credible evidence at this time, I do not consider

it final. Further development in biological secondary treatment processes and advanced methods of treating wastes over the next five to ten years may alter drastically present day concepts of secondary treatment.

Finally, despite my general acceptance of the schedule proposed by the MWRA, I am not convinced that the schedule cannot be significantly accelerated. I also note that the proposed scheduling deadlines concern "major milestones." These dates do not determine the completion dates for many other, important steps that will have to be taken prior to the MWRA's ability to comply with federal water standards. Even by setting long term target dates at this time, this order does not begin to resolve the timing of other related problems, such as termination of sludge and scum discharges; establishment of interim effluent limits; infiltration/inflow control; and termination of discharges from the many combined sewage overflows ("CSOs") located around the harbor. I am particularly concerned about the CSO problem, since the CSOs are the source of a large portion of the raw sewage discharge in the delicate shallow waters nearest shore. The elimination of the CSO discharges will result in an immediate improvement in the water quality of Boston Harbor.

For these reasons, I adopt the following schedule of proposed target dates. The facilities planners should be instructed to proceed in accordance with these goals. They are urged to incorporate all possible expeditious measures in their plans. At the conclusion of facilities planning I will again review these dates and determine whether significant advancements can be made such as the overlapping of construction of the primary and secondary plants.

A. Design and Construction of Piers and Staging Areas and Facilities Planning

On-Island

a.	Complete Design	December, 1987
b.	Bid Construction	May, 1988
c.	Award Construction	August, 1988
d.	Complete Construction	September, 1989
e.	Attain Operational Status	October, 1989

On-Shore

a.	Complete Design	January, 1988
b.	Bid Construction	June, 1988
c.	Award Construction	September, 1988
d.	Complete Construction	May, 1990
e.	Attain Operational Status	May, 1988

Complete Facilities Planning

B. Construction of Treatment Plant, Outfall and Under-Harbor Transmission Tunnel

Initiate construction of new primary treatment facilities	December, 1990
Complete construction and commence operation of new primary treatment facilities[2]	July, 1995

[2] "Complete construction and commence operation" means substantial completion of the primary facility, with the facility accepting expeditious process of start-up intended to achieve operation at primary treatment for all design flows within six months and full operation of the sludge digestion facilities within twelve months of the above date. The MWRA will evaluate, during facilities planning, the feasibility of completing a portion of the System flows at an earlier date, as well as a schedule for demolition of the existing Nut Island treatment plant. The MWRA will cease operations of the Nut Island treatment facility within six months following initiation of treatment of the South System flows at the New Deer Island primary facility.

Initiate construction of outfall[3]	July, 1991
Complete construction of outfall	July, 1994
Initiate construction of under-harbor transmission tunnel	April, 1991
Complete construction of under-harbor transmission tunnel[4]	December, 1994
Initiate construction of secondary treatment facilities	During 1995[5]
Complete construction of secondary	

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[3] The new outfall will accept flows from the existing Deer Island and Nut Island treatment facilities within three months of completion of the outfall or completion of the under-harbor transmission tunnel respectively.

[4] The new under-harbor transmission tunnel will accept flows from the existing Nut Island treatment facility for transfer to the new outfall within three months of completion of the tunnel; provided that the MWRA will, during facilities planning, evaluate the following water quality considerations applicable to the period between completion of the new outfall and tunnel and completion of the new primary plant. The MWRA will investigate during facilities planning the effects of accepting flows from the existing Deer Island and Nut Island facilities for discharge through the new outfall on the water quality of waters adjacent to the Town of Winthrop. The MWRA will conduct modelling studies during facilities planning which will include a demonstration that there will be no deterioration in the quality of such waters, in accordance with the applicable state water standards, as the result of discharge from the existing treatment plants through the new outfall.

[5] The MWRA will, during facilities planning, investigate and determine the extent to which construction of the secondary treatment components of the plant can be reasonably overlapped with the construction of the primary treatment components, in order to produce a plan which achieves secondary treatment in a reasonable and expeditious manner. During facilities planning the MWRA is also directed to investigate and evaluate "construction management" for the facilities construction program in order to provide a basis for determining its efficacy and cost for use in the program. The MWRA shall also take into account during facilities planning any schedule or plan furthering the objective to be specified in accordance with the Court's Third Monthly Compliance Order dated April 8, 1986.

treatment facilities[6] DURING 1999

These are the target deadlines that the parties are ordered to utilize in their facilities planning. I urge the parties now, as I have done before, to continue to cooperate in expediting this project. They are encouraged, as always to seek early completion of the tasks scheduled.

For the reasons discussed in my prior Compliance Order Number 3, I reserve decision at this time on the prison relocation issue, although I must note that it is obvious that relocation of the prison is the crux of the scheduling issues.

SO ORDERED.

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United States District Judge

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[6] . "Complete construction and commence operation" means substantial completion of the secondary treatment facility, with the facility accepting flow. Substantial completion is expected to be followed by a period of start-up in order to consistently achieve secondary treatment twelve months following full start-up.

APPENDIX C

AMBIENT SOUND PRESSURE LEVELS, SEPTEMBER 3, 1986, WINTHROP, MA

TABLE C-1

AMBIENT SOUND PRESSURE LEVELS, September 3, 1986, Winthrop, MA

MEASUREMENT LOCATION (TIME OF SURVEY)	L90 dBA	RESIDUAL OCTAVE BAND CENTER FREQUENCY, HZ								
		31	63	125	250	500	1000	2000	4000	8000
1. Engineers House		Not Collected								
2. 150 Tafts (1300-1310)	45	Not Collected								
4. Tafts & Otis (1337-1347)	43	Not Collected								
5. Shirley & Triton (1450-1500)	44	Not Collected								
6. Siren & Triton (1414-1424)	40	Not Collected								
7. Harbor View (1500-1510)	42	Not Collected								

NOTE:

Weather conditions: Wind E, < 5 mph, overcast.

APPENDIX C

TABLE C-2

AMBIENT SOUND PRESSURE LEVELS.
September 5, 1986, Winthrop, MA

MEASUREMENT LOCATION (TIME OF SURVEY)	L90 dBA	RESIDUAL OCTAVE BAND CENTER FREQUENCY, HZ								
		31	63	125	250	500	1000	2000	4000	8000
1. Engineers House		Not Collected								
2. 150 Tafts (1000-1015)	51	58	60[1]	63	53	42	37	33	28	25
4. Tafts & Otis (1037-1047)	43	55	55	50	41	38	38	30	30	17
5. Shirley & Triton (1053-1104)	42	55	58	51	49	45	40	32	27	20
6. Siren & Triton (1115-1126)	44	57	57	53	45	38	35	29	29	21
7. Harbor View (1139-1152)	49	61	60[2]	57	49	44	41	37	32	32

NOTES:

[1] Diesels just audible, pulses to 70 dB.
[2] Diesles audible, pulses to 65 dB.

Weather conditions: Winds Light, Southerly, Sky Clear.

APPENDIX C

TABLE C-3

AMBIENT SOUND PRESSURE LEVELS, September 16, 1986, Winthrop, MA

MEASUREMENT LOCATION (TIME OF SURVEY)	L90 dBA	RESIDUAL OCTAVE BAND CENTER FREQUENCY, HZ								
		31	63	125	250	500	1000	2000	4000	8000
1. Engineers House (2200-2210)	53	60	65	60	56	56	49	44	38	27
2. 150 Tafts (2240-2250)	48	Not Collected								
4. Tafts & Otis (2300-2310)	47	Not Collected								
5. Shirley & Triton (2420-2430)	46	Not Collected								
6. Siren & Triton (2339-2349)	46	Not Collected								
7. Harbor View (2358-0008)	48	Not Collected								

NOTE:

Weather conditions: Winds N at 5 mph.

APPENDIX C

TABLE C-4

AMBIENT SOUND PRESSURE LEVELS,
September 17-18, 1986, Winthrop, MA

MEASUREMENT LOCATION (TIME OF SURVEY)	L90 dBA	RESIDUAL OCTAVE BAND CENTER FREQUENCY, HZ								
		31	63	125	250	500	1000	2000	4000	8000
1. Engineers House (0030-0049)	47	60	65	56	51	43.	40	27	33	19
2. 150 Tafts (0010-0024)	40	55	60[1]	53	42	35	29	22	18	15
4. Tafts & Otis (2355-0005)	38	51	52	49	41	36	29	22	15	14
5. Shirley & Triton (2338-2350)	42	55	55	56	49	39	34	26	22	15
6. Siren & Triton (2322-2333)	47	57	57	52	50	46	39	28	25	16
7. Harbor View (2304-2314)	48	53	61	52	45	41	38	38	32	20

NOTE:

[1] Diesels audible, level varies to 70 dB with pulses.
Weather conditions: Wind SW - Light to calm.

APPENDIX C

TABLE C-5

AMBIENT SOUND PRESSURE LEVELS,
September 18-19, 1986, Winthrop, MA

MEASUREMENT LOCATION (TIME OF SURVEY)	L90 dBA	RESIDUAL OCTAVE BAND CENTER FREQUENCY, HZ								
		31	63	125	250	500	1000	2000	4000	8000
1. Engineers House (0025-0036)	48	60	65[1]	57	47	42	37	32	28	18
2. 150 Tafts (2335-2345)	46	57	60[1]	54	46	40	36	32	28	23
4. Tafts & Otis (2314-2325)	42	56	58	55	44	38	34	27	26	18
5. Shirley & Triton (2242-2252)	44	57	57[2]	55	45	40	36	32	30	23
6. Siren & Triton (2250-2309)	43	56	59	51	45	40	34	28	30	22
7. Harbor View (2216-2227)	50	55	60	55	46	45	40	36	35	32

NOTES:

[1] Diesels audible, 70 dB peak.
[2] Perhaps, just audible.
Weather conditions: Wind SW very Light.

APPENDIX D

STATISTICAL AMBIENT SOUND LEVELS

POINT SHIRLEY, WINTHROP, MA

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
01-Sep	17	63.5	56.5	51.5
01-Sep	18	63.0	56.5	51.5
01-Sep	19	62.5	56.5	51.0
01-Sep	20	62.0	55.0	50.0
01-Sep	21	66.0	58.0	50.5
01-Sep	22	66.0	51.0	46.5
01-Sep	23	59.0	47.5	44.5
01-Sep	24	52.0	44.0	42.5
02-Sep	1	54.0	45.5	42.5
02-Sep	2	48.5	42.5	40.5
02-Sep	3	52.5	42.0	39.0
02-Sep	4	53.0	41.5	38.0
02-Sep	5	51.5	43.0	37.0
02-Sep	6	58.0	44.0	39.0
02-Sep	7	76.5	62.0	47.0
02-Sep	8	70.5	52.0	46.5
02-Sep	9	71.5	54.0	48.5
02-Sep	10	72.0	53.0	48.0
02-Sep	11	72.0	50.0	45.5
02-Sep	12	71.5	51.5	46.5
02-Sep	13	73.5	52.0	47.0
02-Sep	14	67.5	50.0	47.0
02-Sep	15	72.0	50.0	46.0
02-Sep	16	70.5	50.0	44.7
02-Sep	17	73.0	49.0	43.0
02-Sep	18	74.0	51.5	44.0
02-Sep	19	70.0	50.0	45.5
02-Sep	20	70.5	49.0	46.0
02-Sep	21	74.0	51.5	47.5
02-Sep	22	73.0	51.0	46.5
02-Sep	23	71.5	48.5	46.0
02-Sep	24	49.0	46.5	45.5

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)		TIME	dBA L10	dBA L50	dBA L90
03-Sep	1	47.5	45.5	44.5	
	03-Sep	2	46.0	44.5	43.5
	03-Sep	3	45.0	44.0	43.0
	03-Sep	4	44.5	43.0	42.0
	03-Sep	5	44.0	42.5	41.5
	03-Sep	6	58.5	45.0	42.5
	03-Sep	7	76.5	55.0	45.5
	03-Sep	8	74.0	53.5	46.0
	03-Sep	9	75.0	55.5	46.5
	03-Sep	10	66.5	48.5	45.5
	03-Sep	11	73.0	51.0	45.5
	03-Sep	12	73.0	50.0	44.0
	03-Sep	13	77.5	54.5	46.0
	03-Sep	14	68.5	47.5	44.0
	03-Sep	15	77.5	51.5	44.5
	03-Sep	16	73.0	52.0	44.5
	03-Sep	17	77.5	54.0	44.0
	03-Sep	18	77.5	55.0	45.0
	03-Sep	19	77.5	58.0	45.5
	03-Sep	20	71.0	49.0	44.0
	03-Sep	21	73.5	52.0	43.5
	03-Sep	22	70.5	45.5	42.0
	03-Sep	23	58.0	42.5	39.5
	03-Sep	24	47.0	40.0	38.0
	04-Sep	1	47.0	39.0	37.5
	04-Sep	2	43.0	37.5	36.0
	04-Sep	3	42.5	36.0	35.0
	04-Sep	4	39.0	36.5	36.0
	04-Sep	5	45.0	42.0	39.0
	04-Sep	6	54.0	46.5	43.5
	04-Sep	7	61.0	55.0	48.5

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
04-Sep	8	61.0	54.0	48.5
04-Sep	9	62.0	54.0	49.0
04-Sep	10	61.5	52.5	47.5
04-Sep	11	74.5	59.5	41.0
04-Sep	12	74.5	60.0	52.5
04-Sep	13	74.0	56.0	51.5
04-Sep	14			
04-Sep	15	73.0	58.0	52.0
04-Sep	16	71.5	54.0	50.0
04-Sep	17	62.0	56.0	51.0
04-Sep	18	61.0	56.0	50.5
04-Sep	19	62.0	53.5	48.5
04-Sep	20	60.5	53.0	48.0
04-Sep	21	60.5	52.0	46.5
04-Sep	22	61.0	51.0	47.0
04-Sep	23	57.0	47.5	45.0
04-Sep	24	52.0	45.5	44.0
05-Sep	1	54.0	46.5	45.0
05-Sep	2	48.5	44.5	43.0
05-Sep	3	48.0	45.5	44.0
05-Sep	4	51.5	47.5	43.0
05-Sep	5	51.5	47.0	44.0
05-Sep	6	59.0	52.5	48.5
05-Sep	7	65.0	58.5	53.0
05-Sep	8	65.0	58.5	53.0
05-Sep	9	64.0	57.5	53.0
05-Sep	10	62.0	57.0	52.5
05-Sep	11	67.5	59.0	53.5
05-Sep	12	75.0	59.0	51.5
05-Sep	13	71.0	56.0	53.0
05-Sep	14	64.5	57.0	52.0

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Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	L50	L90
05-Sep	15	62.5	55.5	52.0
05-Sep	16	63.5	57.0	51.5
05-Sep	17	62.0	56.5	51.0
05-Sep	18	62.0	55.5	49.0
05-Sep	19	61.5	55.5	49.5
05-Sep	20	63.0	56.0	47.0
05-Sep	21	63.0	54.5	48.5
05-Sep	22	59.5	49.5	46.5
05-Sep	23	53.5	45.5	43.0
05-Sep	24	44.5	42.5	42.0
06-Sep	1	44.0	42.0	41.0
06-Sep	2	44.5	42.5	41.5
06-Sep	3	44.0	42.0	40.5
06-Sep	4	45.0	42.5	41.0
06-Sep	5	47.5	43.0	41.5
06-Sep	6	56.5	49.0	46.0
06-Sep	7	62.0	53.0	46.0
06-Sep	8	61.5	53.5	42.5
06-Sep	9	62.0	53.0	45.0
06-Sep	10	61.5	55.5	50.0
06-Sep	11	69.0	58.0	51.0
06-Sep	12	74.0	58.0	53.0
06-Sep	13	68.0	57.0	53.0
06-Sep	14	70.0	57.5	53.0
06-Sep	15	71.0	59.5	55.5
06-Sep	16	74.0	59.5	54.5
06-Sep	17	63.0	57.0	51.5
06-Sep	18	61.0	54.5	49.0
06-Sep	19	61.5	54.5	49.0
06-Sep	20	60.0	53.5	46.0
06-Sep	21	60.0	52.5	46.0

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Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
06-Sep	22	62.0	52.0	47.5
06-Sep	23	55.0	48.0	46.5
06-Sep	24	50.0	48.0	46.5
07-Sep	1	50.0	48.5	47.0
07-Sep	2	49.5	47.5	47.0
07-Sep	3	50.0	47.0	45.0
07-Sep	4	48.0	47.0	46.0
07-Sep	5	50.5	47.5	46.5
07-Sep	6	67.5	53.5	49.5
07-Sep	7	70.5	61.5	55.0
07-Sep	8	63.0	56.5	50.0
07-Sep	9	64.5	58.0	51.0
07-Sep	10	61.0	53.0	47.0
07-Sep	11	61.5	54.0	47.0
07-Sep	12	60.0	53.0	47.0
07-Sep	13	60.0	51.5	46.5
07-Sep	14	60.0	52.0	47.5
07-Sep	15	59.0	52.5	48.5
07-Sep	16	61.0	55.0	49.5
07-Sep	17	60.0	54.0	48.0
07-Sep	18	62.5	57.0	50.5
07-Sep	19	59.5	53.5	48.0
07-Sep	20	65.0	54.0	46.5
07-Sep	21	66.5	56.0	46.5
07-Sep	22	68.5	57.5	48.5
07-Sep	23	59.5	50.5	48.0
07-Sep	24	55.5	48.5	46.0
08-Sep	1	58.0	47.0	45.0
08-Sep	2	50.5	46.0	44.5
08-Sep	3	50.0	47.5	45.5
08-Sep	4	48.0	45.5	44.0

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Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
08-Sep	5	53.5	48.0	46.0
08-Sep	6	62.5	54.5	51.0
08-Sep	7	68.0	60.5	55.5
08-Sep	8	66.5	59.5	53.5
08-Sep	9	67.5	60.5	53.0
08-Sep	10	63.0	52.5	46.0
08-Sep	11	62.0	56.0	48.5
08-Sep	12	64.5	56.5	50.5
08-Sep	13	61.0	54.5	49.5
08-Sep	14	62.5	55.5	51.0
08-Sep	15	62.0	55.0	50.5
08-Sep	16	63.0	56.0	51.0
08-Sep	17	63.5	56.5	51.0
08-Sep	18	65.6	56.5	52.5
08-Sep	19	65.0	58.5	53.0
08-Sep	20	65.0	58.5	52.0
08-Sep	21	67.0	56.5	49.0
08-Sep	22	66.0	56.5	51.0
08-Sep	23	61.0	50.0	48.5
08-Sep	24	53.0	51.0	49.0
09-Sep	1	62.5	51.5	49.5
09-Sep	2	53.0	49.5	47.5
09-Sep	3	49.0	47.0	45.5
09-Sep	4	49.0	47.0	46.0
09-Sep	5	51.5	47.5	46.5
09-Sep	6	64.0	54.5	51.5
09-Sep	7	67.5	61.5	55.0
09-Sep	8	66.5	60.0	56.0
09-Sep	9	65.0	58.5	54.5
09-Sep	10	60.5	53.5	49.0
09-Sep	11	61.0	54.5	50.0

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Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
09-Sep	12	61.5	55.5	52.0
09-Sep	13	59.5	54.5	51.0
09-Sep	14	60.0	54.5	52.0
09-Sep	15	61.5	56.0	53.0
09-Sep	16	63.0	58.5	56.0
09-Sep	17	64.0	60.0	57.5
09-Sep	18	63.5	60.0	58.0
09-Sep	19	64.0	58.5	56.0
09-Sep	20	63.5	57.0	54.0
09-Sep	21	65.0	55.0	51.5
09-Sep	22	67.0	51.5	49.0
09-Sep	23	56.0	51.5	49.5
09-Sep	24	56.0	54.5	53.0
10-Sep	1	58.5	57.0	55.5
10-Sep	2	58.5	57.0	56.0
10-Sep	3	58.5	57.0	55.0
10-Sep	4	58.0	56.0	55.0
10-Sep	5	58.0	56.0	54.5
10-Sep	6	62.5	56.5	55.0
10-Sep	7	65.0	59.5	56.5
10-Sep	8	64.5	59.5	57.5
10-Sep	9	64.0	59.0	56.5
10-Sep	10	62.0	57.0	55.5
10-Sep	11	62.5	59.0	56.0
10-Sep	12	63.0	60.0	59.0
10-Sep	13	63.0	60.5	59.0
10-Sep	14	64.0	62.0	60.0
10-Sep	15	63.5	60.5	58.5
10-Sep	16	64.0	60.5	58.5
10-Sep	17	64.0	60.5	58.0
10-Sep	18	64.5	60.5	58.0

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Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	L50	L90
10-Sep	19	64.5	60.0	57.5
10-Sep	20	64.5	58.5	56.0
10-Sep	21	65.0	58.5	56.0
10-Sep	22	63.0	56.5	54.0
10-Sep	23	59.0	54.0	52.0
10-Sep	24	57.5	56.0	54.5
11-Sep	1	59.0	58.0	56.5
11-Sep	2	58.5	57.5	56.5
11-Sep	3	59.5	58.0	57.0
11-Sep	4	58.0	57.0	56.0
11-Sep	5	58.5	57.0	55.5
11-Sep	6	61.0	56.5	54.5
11-Sep	7	64.5	60.5	58.0
11-Sep	8	65.0	61.0	59.5
11-Sep	9	65.0	61.0	59.5
11-Sep	10	63.5	60.0	58.0
11-Sep	11	64.0	60.0	57.5
11-Sep	12	63.5	58.5	56.5
11-Sep	13	64.5	60.0	58.0
11-Sep	14	62.5	59.5	58.0
11-Sep	15	63.0	59.0	57.0
11-Sep	16	63.5	59.0	56.5
11-Sep	17	64.0	58.0	55.0
11-Sep	18	64.0	58.5	56.0
11-Sep	19	68.0	60.0	56.0
11-Sep	20	65.0	58.0	53.5
11-Sep	21	66.0	60.0	54.5
11-Sep	22	65.5	59.5	53.0
11-Sep	23	64.5	55.0	51.5
11-Sep	24	56.5	52.5	51.5
12-Sep	1	57.0	54.0	52.5

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Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
12-Sep	2	53.0	51.5	50.5
12-Sep	3	52.0	51.0	50.0
12-Sep	4	53.0	51.5	50.5
12-Sep	5	52.0	50.0	47.5
12-Sep	6	67.0	51.5	47.5
12-Sep	7	77.0	62.0	54.5
12-Sep	8	74.0	60.0	50.0
12-Sep	9	72.0	60.0	54.0
12-Sep	10	67.5	56.0	50.0
12-Sep	11	74.0	58.5	51.0
12-Sep	12	76.0	59.0	50.0
12-Sep	13	67.0	55.0	50.0
12-Sep	14	70.5	56.5	50.5
12-Sep	15	70.5	57.5	53.0
12-Sep	16	63.5	57.0	53.0
12-Sep	17	62.5	56.5	52.5
12-Sep	18	63.5	57.0	52.5
12-Sep	19	63.0	56.0	51.0
12-Sep	20	65.0	57.0	50.5
12-Sep	21	64.0	55.0	53.0
12-Sep	22	59.5	55.5	54.0
12-Sep	23	57.0	54.0	51.5
12-Sep	24	51.0	49.5	49.0
13-Sep	1	51.0	48.5	47.0
13-Sep	2	49.5	45.5	42.0
13-Sep	3	43.0	41.0	39.0
13-Sep	4	47.0	41.5	39.5
13-Sep	5	48.5	46.5	45.5
13-Sep	6	64.0	48.0	45.5
13-Sep	7	70.5	56.5	49.0
13-Sep	8	71.5	57.0	47.0

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
13-Sep	9	73.0	57.0	51.0
13-Sep	10	67.5	54.5	49.5
13-Sep	11	73.5	59.0	51.0
14-Sep	12	71.0	59.5	52.5
14-Sep	13	62.5	55.5	51.5
14-Sep	14	64.5	58.0	51.5
14-Sep	15	60.5	53.5	48.5
14-Sep	16	61.5	54.0	47.0
14-Sep	17	62.5	55.0	46.5
14-Sep	18	61.0	53.5	46.0
14-Sep	19	62.5	54.5	47.5
14-Sep	20	62.5	52.5	45.0
14-Sep	21	60.5	51.5	42.0
14-Sep	22	60.5	50.0	42.5
14-Sep	23	56.5	45.5	40.0
14-Sep	24	52.5	41.0	39.5
15-Sep	1	47.0	44.0	42.0
15-Sep	2	43.0	41.5	40.0
15-Sep	3	56.5	46.5	42.0
15-Sep	4	54.5	48.5	43.5
15-Sep	5	88.5	52.5	45.0
15-Sep	6	76.0	57.5	46.0
15-Sep	7	82.0	62.0	54.0
15-Sep	8	82.0	63.5	52.5
15-Sep	9	71.0	60.0	51.5
15-Sep	10	69.5	58.5	51.5
15-Sep	11	70.0	59.5	53.0
15-Sep	12	70.0	60.5	53.0
15-Sep	13	71.5	59.0	52.0
15-Sep	14	68.0	59.0	52.5
15-Sep	15	72.5	62.0	54.5

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Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	L50	L90
15-Sep	16	71.5	61.5	55.0
15-Sep	17	73.0	62.5	56.5
15-Sep	18	72.0	61.0	55.0
15-Sep	19	72.5	60.0	54.5
15-Sep	20	67.0	57.0	50.5
15-Sep	21	66.0	56.0	49.5
15-Sep	22	55.0	54.5	49.5
15-Sep	23	59.0	52.0	49.0
15-Sep	24	56.5	50.0	47.5
16-Sep	1	53.5	49.0	46.5
16-Sep	2	55.0	49.0	46.5
16-Sep	3	49.5	44.5	43.0
16-Sep	4	48.0	45.0	43.5
16-Sep	5	47.5	45.0	44.0
16-Sep	6	65.0	51.0	46.5
16-Sep	7	69.5	57.5	50.5
16-Sep	8	68.5	57.5	50.0
16-Sep	9	68.0	56.5	49.0
16-Sep	10	62.0	54.5	44.0
16-Sep	11	65.0	55.0	45.5
16-Sep	12	65.5	53.5	45.0
16-Sep	13	61.5	49.0	43.5
16-Sep	14	69.5	48.5	44.5
16-Sep	15	72.0	50.0	44.5
16-Sep	16	74.0	53.0	47.5
16-Sep	17	77.0	55.5	47.0
16-Sep	18	78.0	56.0	50.0
16-Sep	19	76.5	53.5	48.0
16-Sep	20	56.5	48.0	44.0
16-Sep	21	60.5	50.0	43.0
16-Sep	22	59.0	48.0	42.0

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Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
16-Sep	23	57.0	43.5	41.0
16-Sep	24	46.5	41.5	40.0
17-Sep	1	48.5	40.0	38.5
17-Sep	2	48.0	44.0	39.0
17-Sep	3	43.0	39.5	38.5
17-Sep	4	41.5	39.5	38.5
17-Sep	5	51.5	44.5	39.5
17-Sep	6	62.0	50.0	44.0
17-Sep	7	64.5	59.0	53.5
17-Sep	8	64.5	59.0	54.0
17-Sep	9	62.5	56.0	50.5
17-Sep	10	60.0	54.0	48.5
17-Sep	11	61.0	54.0	47.5
17-Sep	12	61.0	54.0	49.0
17-Sep	13	58.5	52.0	47.0
17-Sep	14	58.5	52.0	48.5
17-Sep	15	59.5	53.0	50.0
17-Sep	16	59.0	53.0	50.0
17-Sep	17	61.5	54.5	50.5
17-Sep	18	62.0	55.0	49.5
17-Sep	19	62.0	55.5	51.0
17-Sep	20	61.0	55.5	50.0
17-Sep	21	62.5	53.5	48.5
17-Sep	22	62.0	52.0	45.0
17-Sep	23	56.5	48.0	44.5
17-Sep	24	56.5	47.5	42.5
18-Sep	1	51.0	47.5	44.0
18-Sep	2	49.5	47.5	46.5
18-Sep	3	48.5	47.5	46.0
18-Sep	4	52.0	49.0	43.5
18-Sep	5	50.5	46.0	42.5

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
18-Sep	6	59.5	49.5	45.0
18-Sep	7	63.5	57.0	50.5
18-Sep	8	64.0	57.0	51.5
18-Sep	9	61.5	54.5	48.0
18-Sep	10	60.0	50.0	45.0
18-Sep	11	62.0	54.0	46.0

APPENDIX E

LETTER FROM VALERIE A. TALMAGE, EXECUTIVE DIRECTOR, STATE HISTORIC PRESERVATION OFFICER, MASSACHUSETTS HISTORICAL COMMISSION

The Commonwealth of Massachusetts

Office of the Secretary of State
Michael Joseph Connolly, Secretary

Massachusetts Historical Commission
Valerie A. Talmage
Executive Director
State Historic Preservation Officer

December 6, 1985

Mr. Michael Deland
Regional Administrator
Environmental Protection Agency
JFK Building
Boston, MA 02203

RE: Harbor Island Treatment Plant

Dear Mr. Deland:

Staff of the MHC have reviewed the historic and architectural survey of Deer Island prepared for the Massachusetts Water Resources Authority by CDM and Boston Affiliates.

In review of this material, we find that the Deer Island Pump Station Complex appears to meet National Register Criteria A and C.

The Pumping Station meets criteria A and C,

1) as a substantially intact sewage pumping complex illustrating the development of the Metropolitan District Commission, one of the earliest major environmental management agencies in the country, and of the City of Boston and its surrounding area, which experienced substantial growth at the turn of the century and
2) as an architecturally distinguished pair of buildings in the Romanesque Revival and Queen Anne styles. The pumping station, built between 1894-99, is notable for it high quality design and materials while the adjoining farmhouse is a particularly good example of Queen Anne/Shingle Style architecture.

We further found that the Deer Island prison complex does not meet National Register of Historic Places Criteria, but that several components individually meet NR criteria.

While individual components of the Prison Complex do retain integrity to their period of significance, the complex as a whole does not, having been altered through the construction of numerous small utility buildings in the 1940s, 1950s, and 1960s and through the demolition or substantial alteration of original elements and significant later structures, such

as the ca. 1850 House of Industry and the Pauper Boy's School.

Components considered to retain integrity to their period of significance and to meet National Register criteria A and C on the local level are the following:

Hill Prison (1902-04) - Classical Revival building retaining significant elements of its design; significant for its associations with the development of institutional controls in the city of Boston; as an illustration of the continued usage of the Harbor Islands as the historic location of undesirable social institutions (Boston's institutional fringe) and architecturally as a good example of turn-of-the-century institutional design and practice, reflecting current philosophies regarding criminal justice and social reform.

The Superintendants Office (ca. 1910) is an excellent example of Georgian Revival architecture in a good state of preservation. Historically, the office reflects the importance and high status of the Superintendant in its prominent siting and imposing design.

This evaluation of resources in the impact area has been undertaken to assist your agency in compliance with 36 CFR 800, the Advisory Council Regulations.

If you should have any questions, please contact Joseph R. Orfant, Brona Simon or Sarah Zimmerman of the MHC staff.

Sincerely,

Valerie Talmage

Valerie A. Talmage
Executive Director
State Historic Preservation Officer
Massachusetts Historical Commission

cc: M. Hodgson, MWRA
S. Rafferty, CDM
S. Moss, Boston Affiliates
Boston Landmarks Commission

VAT/dr

APPENDIX F

ENVIRONMENTAL NOTIFICATION FORM

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

ENVIRONMENTAL NOTIFICATION FORM

I. SUMMARY

A. Project Identification

1. **Project Name** Deer Island Wastewater Treatment Facility Plan and Construction

2. **Project Proponent** Mass. Water Resources Authority (Eng.Div.)
   Address 100 First Avenue, Boston, MA 02129

B. Project Description: (City/Town(s) Boston/Quincy/Winthrop/Chelsea

1. **Location within city/town or street address** Deer Island/Nut Island/Long Island

2. **Est. Commencement Date:** Plng-5/86 Const.12/90 **Est. Completion Date:** Plng-12/87 Const.-1999
   Approx. Cost $ 1.1 Billion (1985) **Current Status of Project Design:** 0 **% Complete**

C. Narrative Summary of Project

Describe project and give a description of the general project boundaries and the present use of the project area. (If necessary, use back of this page to complete summary).

The Massachusetts Water Resources Authority (MWRA) proposes to plan, design and construct a secondary wastewater treatment facility of approximately 500 MGD average capacity (approximately 1,240 MGD peak capacity) on Deer Island to serve the needs of the communities served by the MWRA. To support the timely implementation of the project, the MWRA requests that consideration be given during environmental scoping to formulate procedures allowing for early environmental impact review of the major project components, consistent with a major and complicated project. The project can be subdivided into the following major components:

1. Construction of an interisland transport conduit from the Nut Island headworks to Deer Island, with probable access shafts, if required, on Long Island;

2. Construction of an outfall conduit and outfall structure to convey effluent from the new treatment plant to Boston Harbor or Massachusetts Bay, and the performance of studies to characterize wastewater flowrate and pollutant loadings which will constitute the design basis for the ocean outfall and treatment facility;

3. Selection of treatment plant design.

Copies of this may be obtained from:
Name: Sarah Warner(1) Elisa Speranza(2) **Firm/Agency:** MWRA
Address: (1) Eng. Div., 4th Fl., 20 Somerset St., Boston, MA 02108
(2) Charlestown Navy Yard, 100 First Avenue, Boston, MA 02129
Phone No. (1) 727-8881 (2) 242-6000

1979 **THIS IS AN IMPORTANT NOTICE. COMMENT PERIOD IS LIMITED.**
For Information, call (617) 727-5830

4. Development of a Deer Island site plan and construction of wastewater treatment plant and support facilities.

Other items may warrant accelerated review to accommodate site development and electrical power needs.

Also included in the project are the development of a Citizens Advisory Committee and implementation of a public participation program; assessments of alternative construction methods, and schedules; treatment and disinfection processes, configurations and site layouts; odor and noise control; landside utility service provisions; air quality controls; and adequacy of the Columbus Park, Ward Street, and Chelsea Creek headworks. At Nut Island, existing treatment facilities will be replaced with a new headworks facility.

Project areas and boundaries include: all of Nut Island and Deer Island; the remote headworks facilities located at Columbus Park, Ward Street and Chelsea Creek; a small portion of Long Island; a subsurface zone beneath Boston Harbor from Nut Island to Long Island to Deer Island; and a similar subsurface zone from Deer Island to the ocean outfall terminus. A 26 acre portion of the 210 acre Deer Island is currently used for the MWRA's primary wastewater treatment facility. The Deer Island House of Correction prison facilities occupy an additional 40 acres. The remainder, owned by the MDC, federal government, and the City of Boston, is open space. All of the 17 acre Nut Island in Quincy is currently dedicated to the MWRA's primary wastewater treatment facility. The remote headworks locations are currently used for preliminary treatment facilities for the wastewater prior to entering the tunnel system. The primary use at Boston's 213 acre Long Island is the Long Island Chronic Disease Hospital. It occupies 60 acres in the middle of the island. The southern part of the island is occupied by an abandoned Nike missile base of about 12 acres, which also includes an historical cemetary of about 4 acres. The balance of the island includes 5 acres of freshwater wetlands, about 11 acres of salt marsh, 1900 feet of barrier beach, a former military parade ground and varied open space/recreational area.

The project, as described above, will be addressed in facilities planning and environmental documents for the secondary wastewater treatment plant. Residuals management and site access are currently being addressed in separate planning and environmental documents. For residuals management, refer to EOEA Project Nos. 5832 (long-term residuals management) and 5833 (interim ocean disposal). For site access refer to EOEA Project Nos. 5938 (transport) and 5939 (onshore facilities).

This project is one which is categorically included and therefore automatically requires preparation of an Environmental Impact Report: YES X NO ____

D. Scoping (Complete Sections II and III first, before completing this section.)

1. Check those areas which would be important to examine in the event that an EIR is required for this project. This information is important so that significant areas of concern can be identified as early as possible, in order to expedite analysis and review.

	Construction Impacts	Long Term Impacts		Construction Impacts	Long Term Impacts
Open Space & Recreation	X	X	Mineral Resources		
Historical	X	X	Energy Use	X	X
Archaeological	X	X	Water Supply & Use	X	X
Fisheries & Wildlife	X	X	Water Pollution	X	X
Vegetation, Trees	X	X	Air Pollution	X	X
Other Biological Systems			Noise	X	X
Inland Wetlands			Traffic	X	X
Coastal Wetlands or Beaches	X	X	Solid Waste	X	X
Flood Hazard Areas	X	X	Aesthetics	X	X
Chemicals, Hazardous Substances, High Risk Operations	X	X	Wind and Shadow		
			Growth Impacts		X
Geologically Unstable Areas			Community/Housing and the Built Environment	X	
Agricultural Land					
Other (Specify) ____					

2. List the alternatives which you would consider to be feasible in the event an EIR is required.

(See Page 2-a)

I D.2 Scoping/Alternatives

Among the alternatives identified to date which will be considered for the project include the following:

Treatment Process - activated sludge, oxygen activated sludge, trickling filter, coupled system, (i.e., combined biological treatment system, such as trickling filter followed by activated sludge), rotating biological contactor, physical/chemical treatment, powdered carbon enhancement of activated sludge, and closed vs. open tankage.

Disinfection - onsite generation of disinfectant, barge delivery of disinfectant, ozonation.

Odor and Noise Control - various alternatives will be considered as appropriate to each process and/or site configuration alternative.

Treatment Process Flow Configurations - combined North and South system treatment, separate North and South system treatment, variable degrees of treatment for wet weather flowrates.

Treatment Plant Support Alternatives - onsite vs. offsite sources of electrical power, service water and potable water, maintenance and administrative facilities.

Transport System Alternatives - near shore vs. offshore outfall locations; tunnel, trench, or sunken tube construction methods for ocean outfall and interisland transport conduit; location of tunnel access shafts and interisland transport conduit.

Nut Island Headworks Alternatives - reuse of existing facilities vs. construction of new facility, pumping station vs. gravity flow, at grade vs. below grade structures, multiple land use of Nut Island subsequent to termination of primary treatment operation.

Remote Headworks - modifications, if required, for projected flow and loading and air quality control.

Construction Sequencing Alternatives - alternative construction sequence packages will be evaluated.

E. Has this project been filed with EOEA before? Yes X No ____
If Yes, EOEA No. 4911 EOEA Action? Siting of Wastewater Treatment Facilities for Boston Harbor, Nov. 1985-FEIR Approved with provision for further review, 1/31/86.

F. Does this project fall under the jurisdiction of NEPA? Yes X No ____
If Yes, which Federal Agency? U.S. EPA NEPA Status? Siting FEIS-Record of Decision (ROD) Issued 2/8
Facilities Plan Status to be determined

G. List the State or Federal agencies from which permits will be sought:

Agency Name	Type of Permit
U.S. Environmental Protection Agency	NPDES Discharge Permit
U.S. Army Corps of Engineers	Activities in Navigable Waters
Mass. Department of Environmental Quality Engineering	Discharge Permit, Waterway License, Air Plans Approval.
Federal Aviation Administration	Approval of Plans for Structures
Mass. Coastal Zone Management Office	Consistency Certification
U.S. Coast Guard	Review/Approval of Plans
Mass. Historical Commission	Review/Approval of Plans

H. Will an Order of Conditions be required under the provisions of the Wetlands Protection Act (Chap. 131, Section 40)?
Yes X No ____
DEQE File No., if applicable: ____

I. List the agencies from which the proponent will seek financial assistance for this project:

Agency Name	Funding Amount
MASS. DEQE, Division of Water Pollution Control	Facil. Planning-$4,760,000 (At 90%) Design & Constr.-$1.1 Billion (unknown funding level)

II. PROJECT DESCRIPTION

A. Include an original 8½ x11 inch or larger section of the most recent U.S.G.S. 1:24,000 scale topographic map with the project area location and boundaries clearly shown. Include multiple maps if necessary for large projects. Include other maps, diagrams or aerial photos if the project cannot be clearly shown at U.S.G.S. scale. If available, attach a plan sketch of the proposed project.

B. State total area of project: The project encompasses various areas in the vicinity of Boston Harbor. Headworks and plant site area total approximately 130 acre
Estimate the number of acres (to the nearest 1/10 acre) directly affected that are currently:

1. Developed ..... * acres
2. Open Space/Woodlands/Recreation * acres
3. Wetlands ..... * acres
4. Floodplain ..... * acres
5. Coastal Area ..... * acres
6. Productive Resources
   - Agriculture ..... * acres
   - Forestry ..... * acres
   - Mineral Products ..... * acres

* See Page 3-a, Response II.B.

C. Provide the following dimensions, if applicable:
Length in miles ** Number of Housing Units N/A Number of Stories **

	Existing	Immediate Increase Due to Project
Number of Parking Spaces	**	**
Vehicle Trips to Project Site (average daily traffic)	**	**
Estimated Vehicle Trips past project site	N/A	N/A

D. If the proposed project will require any permit for access to local or state highways, please attach a sketch showing the location of the proposed driveway(s) in relation to the highway and to the general development plan; identifying all local and state highways abutting the development site; and indicating the number of lanes, pavement width, median strips and adjacent driveways on each abutting highway; and indicating the distance to the nearest intersection. No access permits are required.

** See Page 3-a, Response II.C.

II.B. Estimated number of acres directly affected that are currently:

	Deer Island	Nut Island	Long Island
1. Developed	49	17	
2. Open Space/Woodlands/Recreation	57		2-5
3. Wetlands			
4. Flood Plain	5		
5. Coastal Area	111	17	2-5
6. Productive Resources			
Agriculture			
Forestry			
Mineral Products			

II.C Project Dimensions

Length in Miles: Deer Island Outfall - to be determined during the facilities planning effort.
Nut Island/Deer Island Tunnel-5 Miles

Number of Stories: Deer Island facilities not to exceed FAA height limits.

Number of Parking Spaces:

Existing	Immediate Increase Due to Project (Approximate)
Deer Island - 80	Deer Island - 80
Nut Island - 53	Nut Island - 29

Total Vehicle Trips to Project Site (average daily traffic):

Existing	Immediate Increase Due to Project (Approximate)
Deer Island - 168	Deer Island 46
Nut Island - 81	Nut Island 7

II. ASSESSMENT OF POTENTIAL ADVERSE ENVIRONMENTAL IMPACTS

Instructions: **Consider direct and indirect adverse impacts, including those arising from general construction and operations. For every answer explain why significant adverse impact is considered likely or unlikely to result.**

Also, state the *source* of information or other basis for the answers supplied. If the source of the information, in part or in full, is not listed in the ENF, the preparing officer will be assumed to be the source of the information. Such environmental information should be acquired at least in part by field inspection.

A. Open Space and Recreation

1. Might the project affect the condition, use or access to any open space and/or recreation area?
Yes X **No** _____

Explanation and Source: Deer Island - Construction of new treatment facilities will utilize significant land area. The potential for use of the remaining open space will be examined. Long Island - The tunnel access shaft will utilize some open space and/or recreation area which should be insignificant.

Transport System - During construction, there may be some restriction on recreational boating. Due to the limited area and construction duration, impacts will likely be minimal.

B. Historic Resources

1. Might any site or structure of historic significance be affected by the project? Yes X **No** _____

Explanation and Source: Deer Island - The retired steam pump station, the "farmhouse" building and some of the buildings in the prison complex meet the criteria for inclusion on the National Register. The construction of the plant may require the removal of some of these structures.

Nut Island - The demolition and modification of facilities may require the removal of a Quincy monument embedded in a concrete wall. Long Island - Historical structures in the hospital complex and the island sites are not likely to experience significant adverse impacts. SOURCE: Siting FEIR

2. Might any archaeological site be affected by the project? Yes X **No** _____

Explanation and Source: Deer Island - Unmarked graves, the age and extent of which are unknown, exist on the prison grounds. These may have to be relocated. Nut Island - No known archaeological sites exist. Long Island - Five prehistoric sites and an historical cemetery have been uncovered; the Massachusetts Historical Commission has determined Long Island to be an archeological resource. If an access shaft is required for the interisland transport conduit, its location will avoid known archeological sites.

SOURCE: Siting FEIR

C. Ecological Effects

1. Might the project significantly affect fisheries or wildlife, especially any rare or endangered species?
Yes X **No** _____

Explanation and Source: There are believed to be significant fisheries resources along the routes of the interisland transport system and outfall. The facilities planning effort will examine the impact on these resources and identify mitigating measures. While displacement of Deer Island wildlife and removal of habitat will occur as a result of the project, these impacts are not considered to be significant since vegetation and wildlife habitat on Deer Island have not been defined as unique, unusual, or extensive compared with other Boston Harbor Islands. No impact to wildlife at Nut Island is anticipated in view of the negligible level of existing resources. No significant impacts to wildlife at Long Island are expected since the total area required for construction of an access shaft to the interisland transport conduit will only be approximately two acres.

2. **Might the project significantly affect vegetation, especially any rare or endangered species of plant?**
Yes _____ No _X_
(Estimate approximate number of mature trees to be removed: _Minimal_)

Explanation and Source: Deer Island - Due to the previous removal of trees on this island, no mature trees are expected to be encountered. Nut Island - Little vegetation exists on Nut Island. Long Island - Proposed facilities are not expected to be located in an area of mature growth.

No rare or endangered species of plant are known to exist at the proposed sites.

3. **Might the project alter or affect flood hazard areas, inland or coastal wetlands (e.g., estuaries, marshes, sand dunes and beaches, ponds, streams, rivers, fish runs, or shellfish beds)? Yes _X_ No _____**

Explanation and Source: Depending on methods of construction and ultimate location, the interisland conduit and the outfall conduit may impact shellfish beds.

Most construction will not be in flood hazard areas. Any facilities, such as treatment basins, which may be located in flood areas will be protected as required.

4. **Might the project affect shoreline erosion or accretion at the project site, downstream or in nearby coastal areas? Yes _X_ No _____**

Explanation and Source: This project will have minimal shoreline impact, possibly where pipelines or the outfall conduit intersect the shore.

5. **Might the project involve other geologically unstable areas? Yes _____ No _X_**

Explanation and Source: Although there is no active faulting in the Boston Harbor area, the interisland conduit and outfall tunnels will be designed, as required by Massachusetts State Building Code, for seismic loading.

D. **Hazardous Substances**

1. **Might the project involve the use, transportation, storage, release, or disposal of potentially hazardous substances?**
Yes _X_ No _____

Explanation and Source: During construction, fuel oils and solvents will be used. Any wastes will be disposed of off site. During operation, disinfectant and possible dechlorination chemicals will be used. Plant operation may also result in the release of volatile organic compounds (VOC's) to the atmosphere. In addition, the plant effluent, as characterized in other documents (e.g., SDEIR/EIS Siting), will contain potentially hazardous substances. However, the manner in which to manage these compounds will be evaluated in the facilities planning effort.

E. Resource Conservation and Use

1. Might the project affect or eliminate land suitable for agricultural or forestry production?
Yes _____ No X
(Describe any present agricultural land use and farm units affected.)

Explanation and Source: Except for an abandoned pig farm on Deer Island, the areas potentially affected by the project have not been used for agricultural or forestry production. There are no current agricultural land use and farm units in the affected areas.

2. Might the project directly affect the potential use or extraction of mineral or energy resources (e.g., oil, coal, sand & gravel, ores)? Yes _____ No X

Explanation and Source: The areas potentially affected by the project have not been nor are they likely to be used for the extraction of minerals or energy resources.

3. Might the operation of the project result in any increased consumption of energy? Yes X No _____

Explanation and Source:
(If applicable, describe plans for conserving energy resources.) Electrical power is currently provided by onsite diesel generators. Five 700 kilowatt (kw) generators exist and two 6,000 kw generators are being installed as part of the fast-track improvements. The power requirement for the existing plant following improvements is approximately 7,100 kw. Based on the Nut Island Site Options study as updated to reflect the alternatives in the Siting FEIR, approximately 70,000 kw of electrical power from land side supply may be required by the Deer Island primary and secondary treatment facility. Plant design will be optimized for energy efficiency. Depending on results of the residuals management facilities planning, the availability and use of methane gas from sludge digestion as a supplemental fuel will be examined.

F. Water Quality and Quantity

1. Might the project result in significant changes in drainage patterns? Yes _____ No X

Explanation and Source: Drainage patterns will not be significantly changed.

2. Might the project result in the introduction of pollutants into any of the following:
(a) Marine Waters ..... Yes X No _____
(b) Surface Fresh Water Body ..... Yes _____ No X
(c) Ground Water ..... Yes _____ No X

Explain types and quantities of pollutants. Effluent from the secondary treatment plant will be discharged via an ocean outfall. The design capacity of the new treatment facility will be approximately 500 million gallons per day. Effluent limitations proposed in the preliminary draft NPDES permit for the POTW outfall are attached. (See Attachment A)

3. **Will the project generate sanitary sewage?** Yes X No _____

If Yes, Quantity: 6000 **gallons per day**

Disposal by: (a) **Onsite septic systems** ..... Yes _____ No X

(b) **Public sewerage systems** ..... Yes X No _____

(c) **Other means (describe)** N/A

4. **Might the project result in an increase in paved or impervious surface over an aquifer recognized as an important present or future source of water supply?** Yes _____ No X

Explanation and Source:

No aquifer exists that is recognized as an important present or future source of water supply.

5. **Is the project in the watershed of any surface water body used as a drinking water supply?** Yes _____ No X

Are there any public or private drinking water wells within a 1/2-mile radius of the proposed project? Yes _____ No X

Explanation and Source: The project is not in the watershed of a drinking water supply and no drinking water wells are known to exist within a 1/2 mile radius of the proposed project.

6. **Might the operation of the project result in any increased consumption of water?** Yes X No _____

Approximate consumption _____ **gallons per day. Likely water source(s)** MWRA public water supply

Explanation and Source: During construction, approximately 250,000 to 425,000 gallons per day of water may be consumed, primarily for concrete batching and other routine usages.

During operation, an additional 3 to 4 million gallons per day of water may be used for cooling, chemical batching, fire protection, and potable and laboratory water supply. Alternative methods of reusing wastewater for nonpotable water will be evaluated to minimize potable water supply/use.

7. **Does the project involve any dredging?** Yes X No _____

If Yes, indicate:

Quantity of material to be dredged 1 to 1.5 million cubic yards (see below)

Quality of material to be dredged DEQE DWPC Category II or III expected

Proposed method of dredging Not Available

Proposed disposal sites Not known at this time

Proposed season of year for dredging Not Available

Explanation and Source: The method of construction for the interisland conduit has not been selected. In general, possible methods include trenching to bury a pipeline, bedrock tunneling or some combination thereof. Trenching, if chosen for the Nut Island to Deer Island conduit, would generate dredge spoils in the quantities and types described above. Alternatively, tunnel spoils are addressed under Item I. Dredging considerations associated with pier construction are addressed in the site access facility planning project.
SOURCE: Siting FEIR

G. Air Quality

1. **Might the project affect the air quality in the project area or the immediately adjacent area?**
   Yes X No _____

   Describe type and source of any pollution emission from the project site. During construction, emissions will be primarily fugitive dust and exhausts from construction equipment. During plant operation at Deer Island, emissions may include potential exhaust gases from onsite power generation, VOC's, ozone precursors, aerosols/airborne pathogens, and malodorous compounds. At the headworks, emissions may include VOC's and malodorous compounds. The siting FEIR describes mitigation measures which will be employed to control fugitive emissions during construction. The MWRA is committed to treatment plant design and operation which will eliminate offsite odors and protect public health; onsite odors will be controlled to the maximum extent feasible.

2. **Are there any sensitive receptors (e.g., hospitals, schools, residential areas) which would be affected by any pollution emissions caused by the project, including construction dust?** Yes X No _____

   Explanation and Source: At Deer Island, residential areas are approximately 1/2 mile from the plant. During part of the construction period, the House of Correction may be adjacent to the new plant. At Nut Island, residential areas are approximately 100 yds. from the site. At Long Island, there is the hospital complex which may only be impacted during the construction period; residential areas in Quincy are approximately two miles from Long Island.

3. **Will access to the project area be primarily by automobile?** Yes _____ No X

   Describe any special provisions now planned for pedestrian access, carpooling, buses and other mass transit.

   Workers will be bused or ferried to Deer Island. Potential access to the project areas by ferry will be addressed in the site access facility plan. Potential busing of workers to Deer Island and transportation of workers to Nut Island and Long Island will be addressed in this facilities planning effort.

H. Noise

1. **Might the project result in the generation of noise?** Yes X No _____

   Explanation and Source:
   (Include any source of noise during construction or operation, e.g., engine exhaust, pile driving, traffic.)

   Noise levels from construction and operation at Deer Island will not exceed those established and agreed to in the Siting FEIR. These levels are generally more stringent than those required by applicable codes and standards. At Long Island and Nut Island, construction-related noise will occur for a short duration with little to no operation noise. Allowable noise levels for Long Island and Nut Island will be established in the EIR.

2. **Are there any sensitive receptors (e.g., hospitals, schools, residential areas) which would be affected by any noise caused by the project?** Yes X No _____

   Explanation and Source:

   (Refer to the response to Item G.2)

I. Solid Waste

1. Might the project generate solid waste? Yes X No _____

Explanation and Source:
(Estimate types and approximate amounts of waste materials generated, e.g., industrial, domestic, hospital, sewage sludge, construction debris from demolished structures.)

(See Page 9-a, Response III.I.)

J. Aesthetics

1. Might the project cause a change in the visual character of the project area or its environs?
Yes X No _____

Explanation and Source: At Deer Island, the drumlin may be removed and graded to areas not required by new facilities. The site may appear more developed with less open space. At Nut Island, the existing plant will be removed and open space may be created.

2. Are there any proposed structures which might be considered incompatible with existing adjacent structures in the vicinity in terms of size, physical proportion and scale, or significant differences in land use?
Yes _____ No X

Explanation and Source: The proposed use of the island for a wastewater treatment plant is consistent with the current use for wastewater treatment. The House of Correction will be relocated off-site.

3. Might the project impair visual access to waterfront or other scenic areas? Yes X No _____

Explanation and Source: The potential relocation of the drumlin to serve as a visual buffer from the community could change current views from the community.

K. Wind and Shadow

1. Might the project cause wind and shadow impacts on adjacent properties? Yes _____ No X

Explanation and Source:

III.I Solid Waste

Solid waste types and approximate quantities are summarized below:

	Deer Island	Nut Island	Long Island
Demolition debris-cu yd	135,000	45,000	None
Construction waste (e.g., paper, packing, etc.)-cu yd	95,000	5,000	Less than 1,000
Removal/closure of Deer Island grit & screenings landfill-cu yd	100,000 (Note 1)	N/A	N/A
Grit, screenings, sludge, scum	Note 2	Note 2	N/A
Interisland tunnel spoils-cu yd	Note 3	Note 3	Note 3
Excavation spoils-cu yd	3,500,000 (Note 4)	N/A	N/A
Outfall tunnel spoils-cu yd	500,000	N/A	N/A

Note 1: A grit and screenings landfill exists on Deer Island in an area likely to be required for new facilities. DEQE tentatively has an interim landfill closure plan. This material may have to be excavated and either relocated on Deer Island or removed for off-site disposal. The removal/closure of the Deer Island grit and screenings landfill will be addressed during this facilities planning effort.

Note 2: Impacts associated with the disposal of sludge and residuals, will be addressed in the ENF for the Residuals Management Plan. The specific approach to tunneling, if used for the interisland conduit, and the removal of interisland tunnel spoils (i.e., removal at Deer Island, Nut Island, Long Island or a combination thereof) will be evaluated during this facilities planning effort. Excess excavation spoil which can not be used as structural fill will be evaluated for ocean and land disposal. Demolition debris and construction waste which cannot be reused onsite will be transported off-island and disposed of at permitted sanitary landfills. Disposal of these materials is not expected to result in significant environmental impacts, although consumption of landfill capacity will be increased.

Note 3: The total volume of excavation spoils from interisland transport conduit construction is approximately 100,000 cu yd. Location of spoils removal is unknown at this time.

Note 4: Currert transport Facilities Planning has estimated 3,500,000 cu yds as an upper limit if all excavation spoils are removed from Deer Island. This estimate will be refined during this facilities planning effort.

IV. CONSISTENCY WITH PRESENT PLANNING

A. Describe any known conflicts or inconsistencies with current federal, state and local land use, transportation, open space, recreation and environmental plans and policies. Consult with local or regional planning authorities where appropriate.

There are no known conflicts with current federal, state, and local land use, transportation, open space, recreation, and environmental plans and policies. The use of any remaining areas for open space and recreation will be considered during project planning and environmental impact assessments.

V. FINDINGS AND CERTIFICATION

A. The notice of intent to file this form has been/will be published in the following newspaper(s):

(Name)	(Date)
Boston Globe	June 5, 1986
Patriot Ledger	June 5, 1986
Winthrop Transcript	June 11, 1986
Bay State Banner	June 12, 1986
Chelsea Weekly News	June 12, 1986

B. This form has been circulated to all agencies and persons as required by Appendix B.

June 16, 1986
Date

Daniel K. O'Brien
Signature of Responsible Officer or Project Proponent

Daniel K. O'Brien, P.E., Acting Director Engineering Department
Name (print or type)

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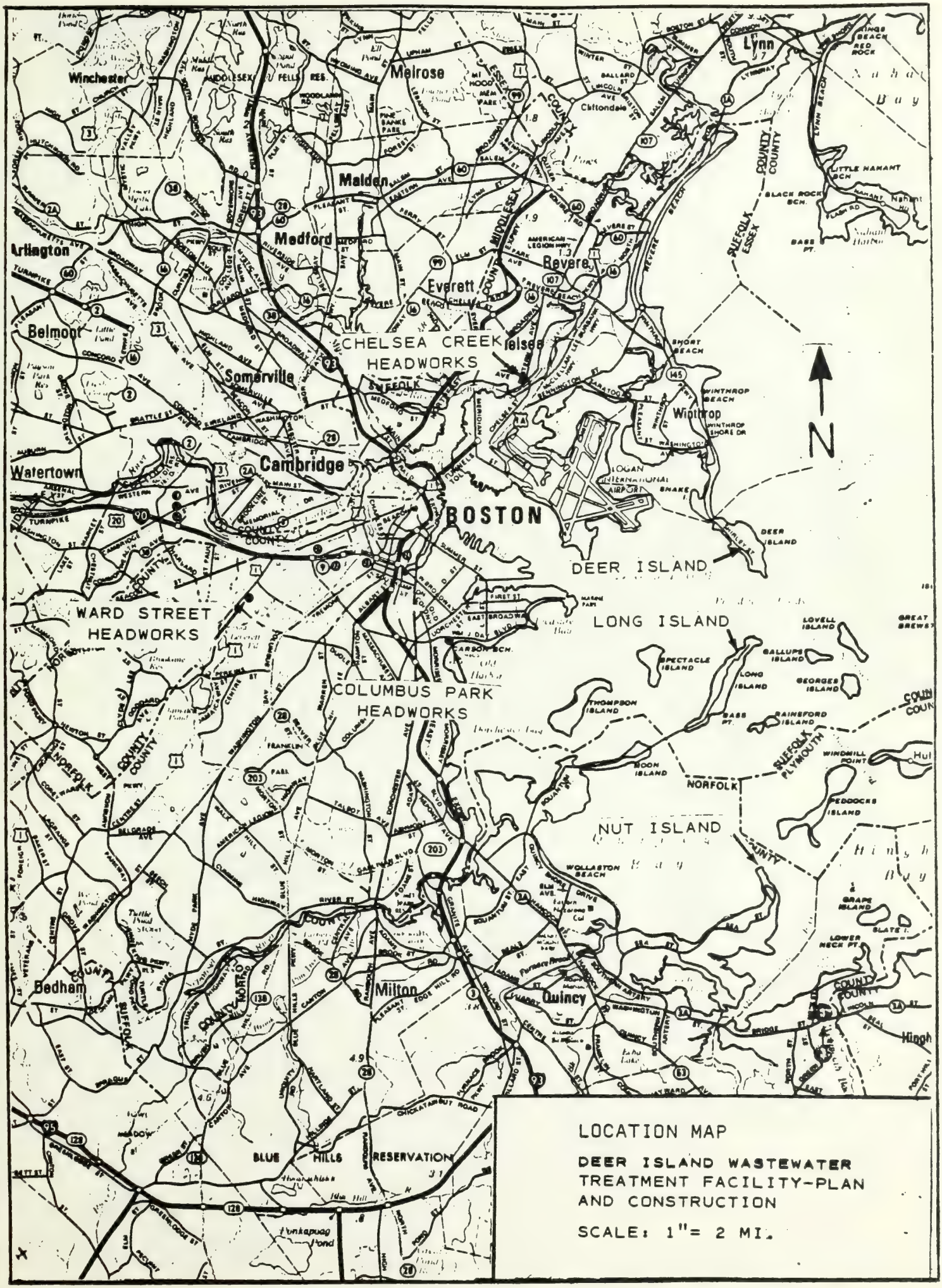
June 16, 1986
Date

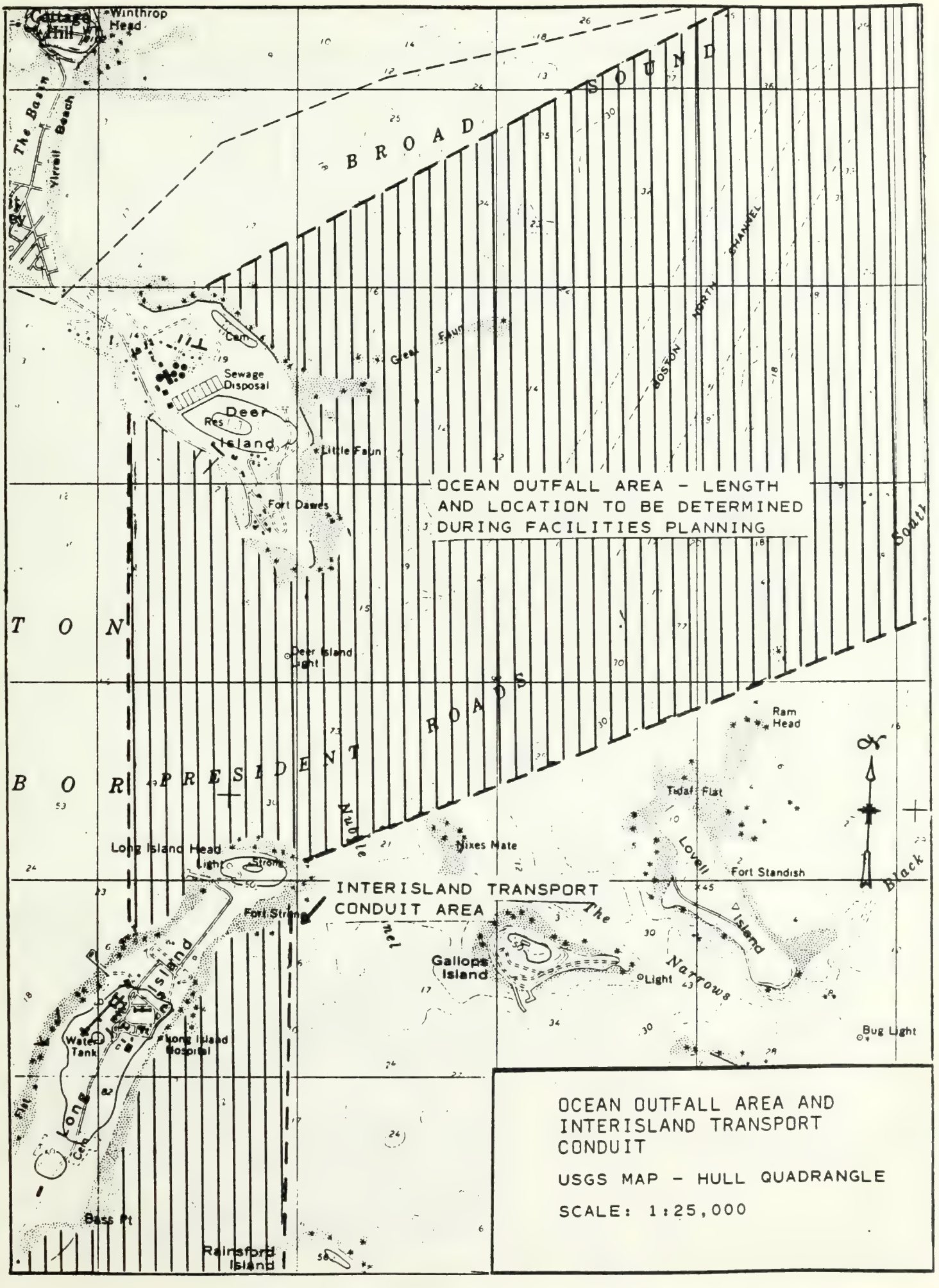
Richard D Fox
Signature of person preparing ENF (if different from above)

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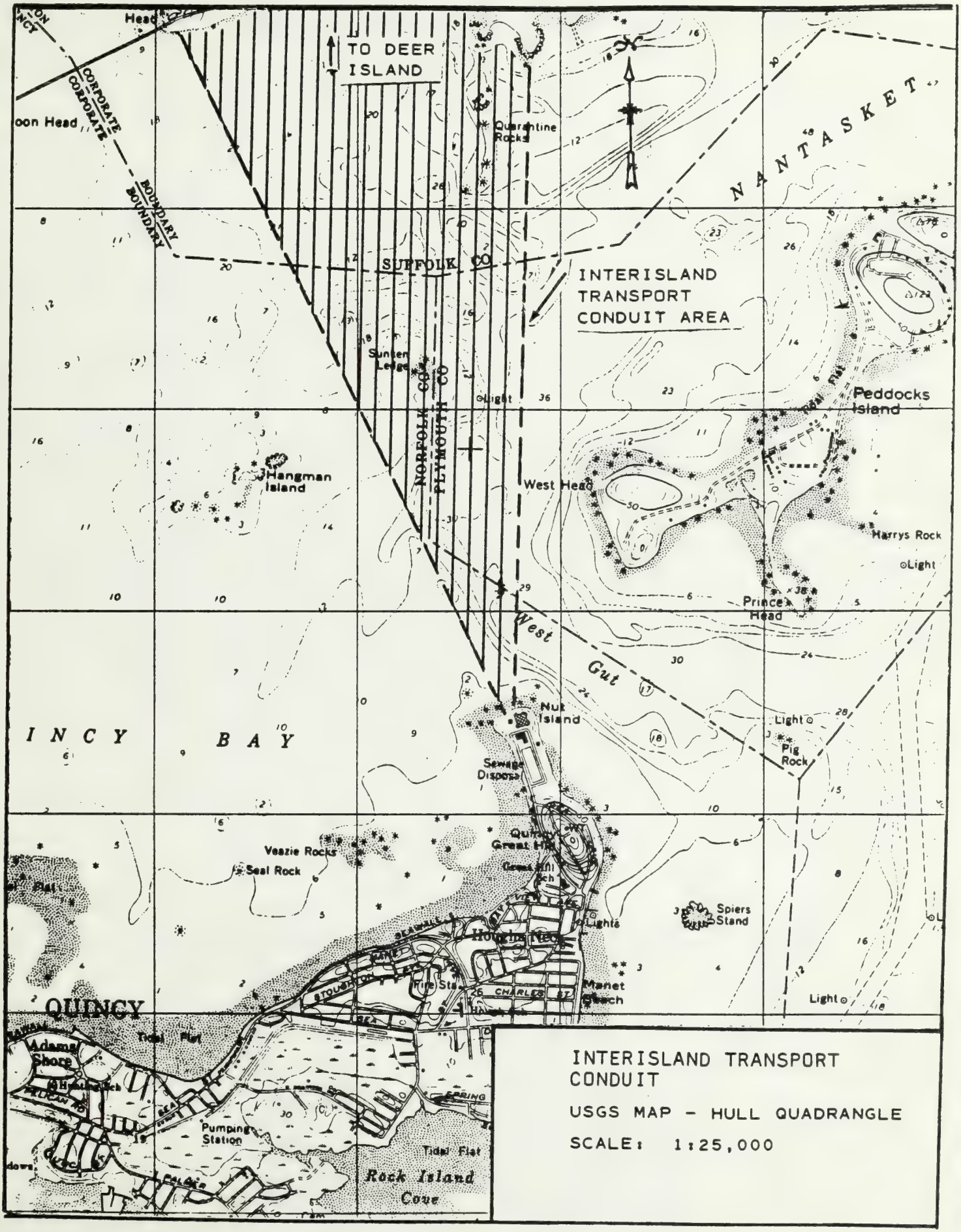

Winchester
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Medford
Arlington
Everett
Revere
Belmont
CHELSEA CREEK
HEADWORKS
Chelsea
Somerville
Winthrop
Watertown
Cambridge
BOSTON
DEER ISLAND
WARD STREET
HEADWORKS
LONG ISLAND
COLUMBUS PARK
HEADWORKS
NUT ISLAND
Quincy
Milton
Bedham
BLUE HILLS RESERVATION
N
LOCATION MAP
DEER ISLAND WASTEWATER
TREATMENT FACILITY-PLAN
AND CONSTRUCTION
SCALE: 1"= 2 MI.



OCEAN OUTFALL AREA AND INTERISLAND TRANSPORT CONDUIT

USGS MAP - HULL QUADRANGLE

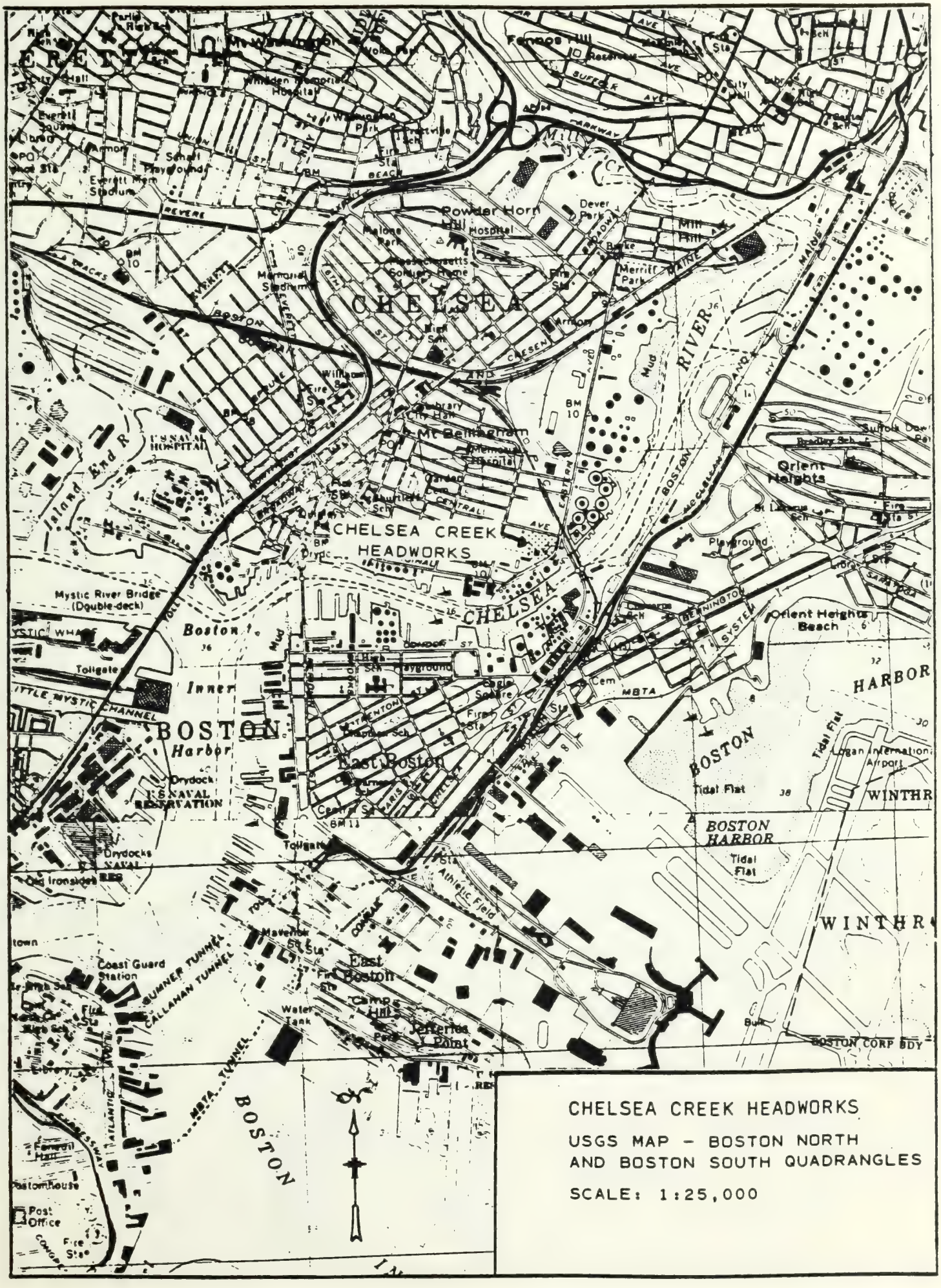
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INTERISLAND TRANSPORT CONDUIT

USGS MAP - HULL QUADRANGLE

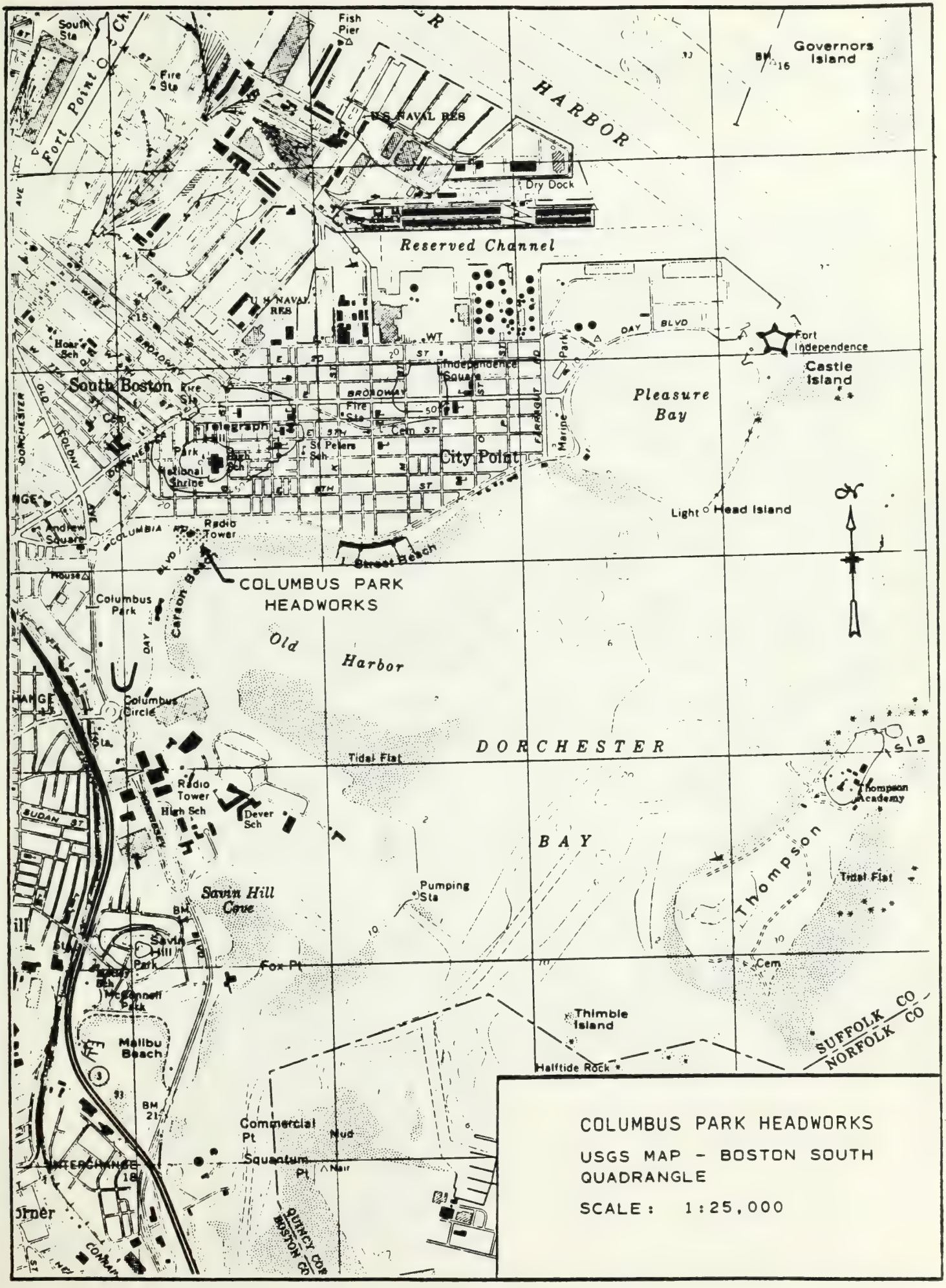
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CHELSEA CREEK HEADWORKS

USGS MAP – BOSTON NORTH
AND BOSTON SOUTH QUADRANGLES

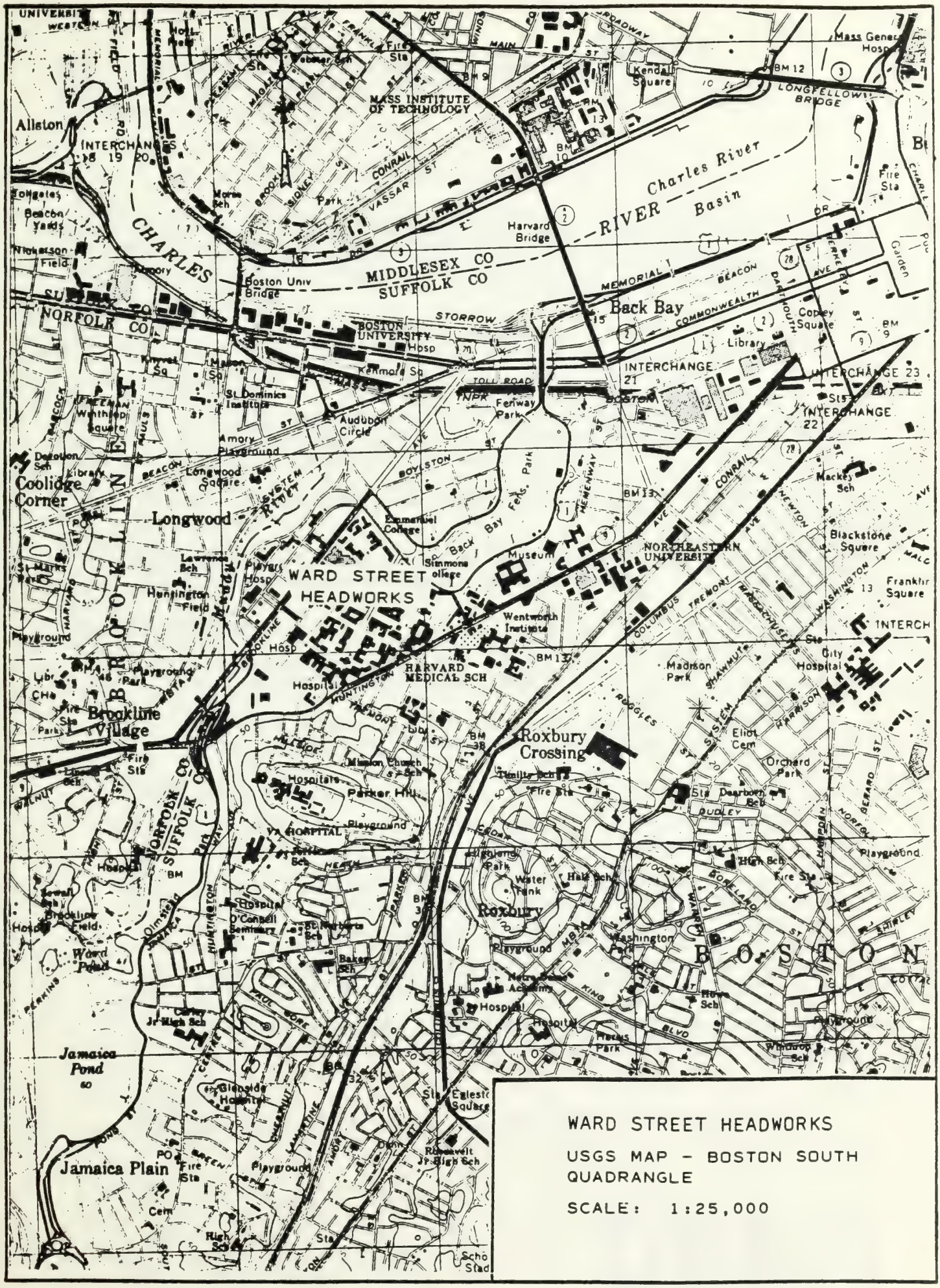
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COLUMBUS PARK HEADWORKS

USGS MAP - BOSTON SOUTH QUADRANGLE

SCALE: 1:25,000



WARD STREET HEADWORKS

USGS MAP – BOSTON SOUTH QUADRANGLE

SCALE: 1:25,000

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Discharge Limitations for All Authorized Discharges: POTW Outfalls Listed in Attachment A; CSO Treatment Facility Outfalls Listed in Attachment B; CSO Outfalls Listed in Attachment C; and Future POTW Outfall(s) to Boston Harbor as Approved by EPA

a. pH

The pH of the effluent shall not be less than:

(1) 6.5 nor greater than 8.5 at any time to Boston Harbor, Boston Harbor/Quincy Bay, Hingham Bay, the Inner Harbor, and the Mystic River; and

(2) 6.5 nor greater than 9.0 at any time to the Charles River

unless these values are exceeded due to natural causes or as a result of approved treatment processes.

b. Aesthetics

(1) The discharge shall not cause objectionable discoloration of the receiving waters.

(2) The effluent shall not cause a visible oil sheen or foam, or contain floating solids at any time.

c. Other Parameters

(1) The permittee shall not discharge any pollutant or combination of pollutants in toxic amounts.

(2) The total chlorine residual and other toxic components of the effluent shall not result in any demonstrable harm to aquatic life or violate any state or federal water quality standard which has been or may be promulgated. Upon promulgation of any such standard, this permit may be modified in accordance with such standard.

(3) The permittee shall minimize the use of chlorine, still maintaining adequate bacterial control.

d. Sludge

The permittee shall not discharge sewage sludge.

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Discharge Limitations for All
Authorized Discharges, continued:

e. Unauthorized Discharges

The permittee is authorized to discharge only in accordance with the terms and conditions of this permit and only from those outfalls listed on page 1 of Part I of this permit. Discharges of wastewater from any other point source, including but not limited to the following, are not authorized:

(1) MWRA pumping stations listed in Attachment D;

(2) mannoles due to surcharging;

(3) outfall 016 (outfall 016, the Malden Overflow, is located at 42°25'12" latitude and 71°04'18" longitude); and

(4) CSO outfalls listed in Attachments B and C during dry weather

unless in accordance with General Requirement m (Bypasses) of Part II of this permit.

f. Bypasses

Bypasses are not authorized unless in accordance with General Condition m of Part II of this permit. Discharges from any point source, including discharges from outfalls not owned by the permittee (e.g., discharges from the Boston Water and Sewer Commission's Moon Island facility) as well as discharges from outfalls owned by the permittee, which are the result of the past, present, or future failure to properly design, operate, or maintain the permittee's POTW or appurtenant facilities in compliance with the terms and conditions of this permit or to adequately control or limit incoming flows to the permittee's POTW shall be considered unauthorized discharges by the permittee (MWRA).

g. New Connections, Increased Flows, and Influent Changes

New connections, increased flows, or changes in influent quantity or quality that will cause violation of the terms and conditions herein are not permitted.

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2. Effluent Limitations and Monitoring Requirements for POTW Outfalls Listed in Attachment A and Future POTW Outfalls Approved by EPA

a. Effluent Limitations and Monitoring Requirements

During the period beginning the effective date and lasting through expiration, the permittee is authorized to discharge effluent to Boston Harbor from POTW outfalls listed in Attachment A and future POTW outfalls approved by EPA.[1] Such discharges shall be limited and monitored by the permittee as specified below and shall be reported by the permittee pursuant to section D on page 20 of Part I:

Effluent Characteristic	Discharge Limitations (specify units) Average Monthly	Average Weekly	Maximum Daily[2]	Monitoring Requirement Measurement Frequency	Sample Type
Flow-m^3/Day (MGD)				Continuous	See Foot-note 3
BOD	30 mg/l	45 mg/l	50 mg/l	Daily	24 Hour Composite
TSS	30 mg/l	45 mg/l	50 mg/l	Daily	24 Hour Composite
Settleable Solids[2]		0.1 ml/l	0.3 ml/l	Daily	Grab
pH[2]	(See A.1.a on page 4 of Part I)			Daily	Grab
Fecal Coliform[2]	200/100 ml	400/100 ml	400/100 ml	3xDaily	Grab
Chlorine, Total Residual[2]	(See A.1.c. on page 4 of Part I and A.2.b on page 7 of Part I)			3xDaily	Grab
Chlorides (Influent only)				Daily	Grab
Oil and Grease of Petroleum Origin[2]			15 mg/l	Weekly	Grab
NOAEL			20% or greater[4]	Monthly	24 Hour Composite
NOEC	10% or greater[5]			Monthly	24 Hour Composite
LC50[6]				Monthly	24 Hour Composite
Volatile Organic Compounds	*** Use EPA Test Method 624 ***			Monthly	Grab

The discharges shall not cause a violation of the water quality standards of the receiving waters.

FOOTNOTES ON PAGE 21 OF PART I.

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Effluent Limitations and Monitoring Requirements for POTW Outfalls Listed in Attachment A and Future POTW Outfalls Approved by EPA, continued:

b. Toxicity Tests and Chemical Analysis

(1) Effluent Monitoring

Beginning the effective date of the permit, the permittee shall perform the following tests once per month on each sample from each POTW. The permittee shall use the sampling and test procedures outlined in Attachment F and shall report the results to the EPA pursuant to section D on page 20 of Part I:

(a) Chronic Toxicity Tests to Establish the NOEC, LOEC and MATC

Chronic toxicity tests on representative 24 hour composite samples of the discharge using each of the following organisms:

(i) the sheepshead minnow, Cyprinodon variegatus (7-day tests to measure growth and survival); and

(ii) the red marine alga, Champia parvula (2 to 4 day tests to evaluate the effects on sexual reproduction).

The endpoints to be established in the chronic tests are the No Observed Effect Concentration (NOEC), the Lowest Observed Effect Concentration (LOEC), and the Maximum Acceptable Toxicant Concentration (MATC).

(b) Acute Static Toxicity Tests to Establish the NOAEL and LC50.

96 hour acute static toxicity tests on representative 24 hour composite samples of the discharge shall be conducted using one to five-day-old juvenile mysid shrimp, Mysidopsis bahia, to establish No Observed Acute Effect Levels (NOAEL) and LC50s of the effluents.

(c) Chemical Analysis

A portion of each effluent sample used for the toxicity tests listed above shall be chemically analyzed to measure the concentrations of the pollutants listed in Appendix D of 40 CFR Part 122. Grab samples shall be taken and analyzed for volatile organic compounds.

The actual detection limit must be specified for all values reported to be below the detection limit.

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Footnotes

1. Future POTW outfall location(s) within Boston Harbor shall require written approval of the U.S. Environmental Protection Agency (EPA).

2. Required for state certification or based on Massachusetts Surface Water Quality Standards.

3. Report maximum and minimum daily rates and total flow for each operating date.

4. "20% or greater" is defined as survival of 90% of the juvenile mysid shrimp, Mysidopsis bahia, in a sample with a concentration of wastewater greater than or equal to 20% (see A.2.b on page 6 of Part I and Attachment F on page 27 of Part I).

5. "10% or greater" is defined as no observed chronic effects on the sheepshead minnows, Cyprinodon variegatus, and the red marine alga, Champia parvula, in a sample with a concentration of wastewater greater than or equal to 10% (see A.2.b on page 7 of Part I and Attachment F on page 27 of Part I).

6. "LC50" is defined as the concentration of wastewater that causes mortality to 50% of the test organisms (see A.2.b on page 7 of Part I and Attachment F on page 27 of Part I).

7. Report maximum, minimum and average flow rates during the first 24 hours of discharge or any portion thereof for discharges of less than 24 hour duration in addition to total flow for the entire period of activation.

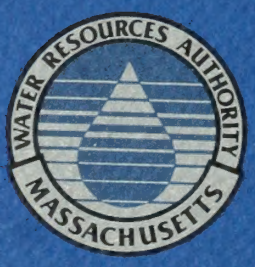
8. Report both influent and effluent results for this parameter.

9. Composite samples are to be collected during the first 24 hours of discharge or any portion thereof for discharges of less than 24 hours duration.

10. Grab sample(s) shall be collected once within the first 2 hours of discharge and every 8 hours thereafter.

11. Grab sample for hexavalent chromium shall be collected within the first 2 hours of discharge.

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WATER RESOURCES AUTHORITY
MASSACHUSETTS